GLANDULAR ENLARGEMENTS

ARTHUR EDMUNDS


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GLANDULAR ENLARGEMENT AND OTHER DISEASES OF THE LYMPHATIC SYSTEM

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Intestine with mesentery from a case of Status Lymphaticus which died during the administration of chloroform. The enlarged lymphatic glands are seen standing out all over the mesentery and there is a large mass of glands at its root.

Frontispiece

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GLANDULAR ENLARGEMENT AND OTHER DISEASES OF THE LYMPHATIC SYSTEM

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PREFACE

This small volume makes no pretension to be an exhaustive treatise on the diseases of the Lymphatic System. Such a monograph would entail a review of practically the whole of medicine and surgery, there being few diseases in which the lymphatic system does not play some part.

The subject has been considered from a practical and from a surgical standpoint, and its limitations have been defined by considering only those pathological conditions, in which affections of the lymphatic vessels or glands constitute the essential feature of the disease.

For the illustrations I am personally largely responsible, but I have had valuable assistance from the Resident Staff at the Great Northern Hospital and at the Children's Hospital, Paddington Green, who have very kindly taken photographs of cases for me. For the skiagram (Fig. 2) I am indebted to my friend Mr. A. D. Reid. For the specimen from which the photograph of the mesentery in the Status Lymphaticus was taken I am indebted to my friend Mr. Gay French.

A. E.

30 Welbeck Street, W.

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CHAPTER I

GENERAL ANATOMICAL CONSIDERATIONS

In the higher animals, the blood is contained in a system of tubular vessels, arteries, capillaries, and veins, so that, except in one or two organs, the blood itself does not come into actual contact with the tissue elements. It is only in those organs, such as the spleen, the bone marrow, and possibly haemolymph glands, which are concerned in the elaboration of the red blood corpuscles, that the blood is found outside the capillary wall and in actual contact with the tissue cells. The constituents of the blood, which are necessary for cellular metabolism, are conveyed from capillary to cell by means of the lymph; and the products of destructive metabolism or secretion are conveyed, by the same medium, back to the blood stream. The lymph is derived from the blood, its constituents passing through the substance of the lining cells or through small interstices between them. To a very large extent, the lymph which has passed through the capillary wall finds its way back into the venous radicles in the neighbourhood, and so establishes

equilibrium. When, however, the flow of lymph is greater—that is to say, when the amount absorbed by the venules is less than the amount which passes through the capillaries—another set of vessels, the lymphatics, comes into play, draining the lymph from the tissue spaces, and preventing stagnation, finally returning it to the blood stream by the thoracic duct.

There has been a great deal of controversy as to the exact method of commencement of the lymphatic capillaries, as the primary radicles of the lymphatic system are called. According to one point of view, which has been largely advocated by Kölliker and von Recklinghausen, the spaces between the tissue cells are in actual open communication with the lymphatic vessels. Other observers maintain that the lymphatic capillaries commence in blind tubes, which form a plexus in the connective tissue, but have no connexion with the intercellular spaces, except through the medium of the endothelium which constitutes their wall. It is very difficult to decide between these two views; but for practical purposes the distinction is not of great importance, inasmuch as fluids, and even solid particles, pass with the greatest readiness from the intercellular spaces into the lymphatic capillaries.

The lymphatic capillary is lined by a layer of endothelial cells with crenated margins, resembling roughly an oak-leaf in shape. These indentations fit

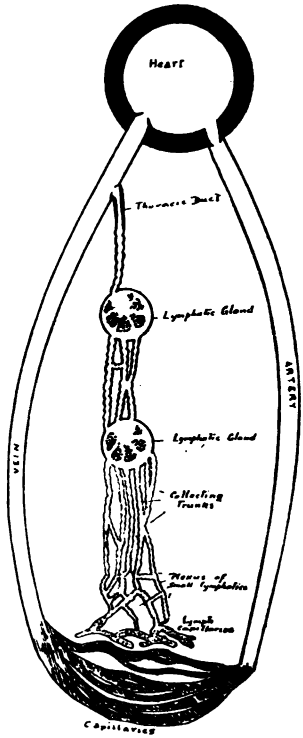

Fig. 1. Schematic representation of the lymphatic system.

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closely into one another, and the cells are separated merely by a thin layer of intercellular material which can readily be stained by means of silver nitrate. This endothelial layer constitutes the entire wall of the capillary, and in some situations, such as tendons, it lies actually in contact with the bundles of fibrous tissue, forming a sort of sheath for these fibres. The lymph capillaries are furthermore closely connected one with another by a series of anastomosing branches of very varying size, some of them being as large as the capillary itself, while others are much smaller.

The lymph capillaries running together form larger trunks, the lymphatic vessels, which resemble in structure the smaller veins. Their walls, however, are very much thinner, and the valves which occur in veins are found in lymphatics at very much shorter intervals. In the smaller vessels, valves occur only a few millimetres apart. Thus: Sappey counted from 60 to 80 in the course of the lymphatics from the finger to the axilla. In the thoracic duct they are found between 6 and 10 centimetres apart. The endothelium resembles that found in the smaller veins, having an outline without the oak-leaf crenation which occurs in the capillaries. The muscular tissue of the veins is represented here also, but in much smaller quantity.

There are a few nerve fibres also present, suggesting that the lymphatic vessels, like the blood-vessels, are under the control of the central nervous system. This

neuro-muscular mechanism is found most highly developed immediately above the valve, where the lymphatic vessel exhibits a slight bulbous enlargement, and it is probable that this serves the purpose of propelling the lymph along the lymphatic vessels.

The anastomosis which was found in the capillaries is also found in the lymphatic vessels, but the general tendency of the branching and union of these structures is the production of fewer and fewer lymphatic trunks, until ultimately the whole of the lymph is collected into two main trunks. The Thoracic Duct receives the lymph from the whole of the body, with the exception of the right side of the head and neck, and upper part of the chest. The lymphatics from these regions unite to form a smaller trunk, known as the Right Lymphatic Duct.

The thoracic duct lies along the front of the bodies of the vertebrae, commencing below in an irregular dilatation called the Receptaculum Chyli, which is situated about the level of the umbilicus. It then passes upwards, receiving many tributaries, until it reaches the level of the fourth thoracic vertebra, where it crosses behind the aorta and the left innominate vein, running up into the root of the neck. Here it forms a horseshoe-shaped curve which turns outwards, between the vertebral and carotid arteries, to open into the junction of the internal jugular and sub-clavian veins, receiving, just before it enters the vein, a good-

sized trunk formed by the union of the lymphatic vessels from the left side of the head and neck. At its point of junction it is provided with a valve, consisting of two semi-lunar folds, which prevents the regurgitation of blood from the vein into the duct. The termination of the thoracic duct in the jugular vein is subject to considerable variation; in a few rare cases it opens at a corresponding point on the other side of the body; more commonly it opens, not into the actual junction of the two great veins, but directly into one or other of them; or it may even have several openings, forming a sort of delta. The right lymphatic duct opens in exactly the same way, at the junction of the corresponding veins on the opposite side. It is probable that these two main communications do not form the only link between the venous and lymphatic canal, but that others exist, especially with the azygos and renal veins.

In many of the lower animals, the lymph which started from the lymph spaces is propelled on its course to the great veins by means of certain contractile sacs, called Lymph Hearts: and it is probable that this mechanism obtains in the human embryo also. In the adult, the lymphatic circulation is kept up by muscular contraction, which squeezes the lymph along the lymphatic vessels, the valves of which direct the course of the currents towards the heart, the muscular tissues of the vessels themselves aiding the circulation

to some extent. The thoracic duct passes throughout the whole length of the thorax, which at every inspiration is the seat of a negative pressure, so that lymph is sucked into the thoracic duct from its various tributaries. The lymph flow is considerable: for example, in one case after division of the thoracic duct it was possible to collect 5½ litres in four hours. The source of this lymph has been seen to be the fluid in the connective tissue spaces, which in its turn is derived from the blood, the exact method of its production being a point of much controversy, the final word upon which has yet to be uttered. Some authorities hold that the process of lymph production is carried out in accord with simple physico-chemical laws, while others maintain that it is actively secreted by the endothelial cells, which are interposed between the termination of the blood-vessels and the commencement of the lymphatic capillaries. It is, however, sufficient to remember that the quantity of lymph produced varies with the intra-capillary blood-pressure, and with the condition of the endothelial cells, leaving it for future work to decide whether the change, which takes place in these cells, is to be regarded as an increase in their permeability, or an increase in their secretory activity.

Lymph is a colourless or slightly yellow fluid, containing white blood corpuscles which are, however, accidental rather than essential constituents. The

lymphatics which come from the alimentary canal contain also a large amount of fat in the form of a fine emulsion, and these have received the name of lacteals, the fluid being called chyle. The lymph which is present in the thoracic duct is always slightly milky from admixture with this fluid, and in addition is often pinkish in colour from the presence of a few red blood corpuscles, possibly derived from the vein, from which they have escaped through the valve at the opening of the duct. In other respects lymph is not very different from blood plasma in chemical composition. It contains about the same amount of salts, but is on the whole rather less alkaline. The amount of fibrinogen is also less than that found in blood ; so that, although it can coagulate, it does so less readily and less firmly than blood.

It is difficult to demonstrate the lymphatic vessels without the aid of injections, but in spite of this the presence of the lymphatic vessels has been recognized from the very earliest times. The first definite mention of them is found in the writings of Aristotle, and the difference between the lymphatics of the abdominal cavity and those of the rest of the body was recognized by Herasistratus, who lived in the third century B.C. As in all anatomical researches, additional knowledge was very slight until the sixteenth century, when Eustachius discovered the thoracic duct, and noticed that its posterior end was enlarged to form the recepta-

culum chyli, into which more than a century later Pecquet was able to trace the mesenteric lacteals. It was reserved for Sappey in the middle of last century to describe in detail the anatomy of the lymphatics in man; and his work was so thorough and complete, that the additions to the knowledge which he obtained by his researches have been merely matters of detail. This observer employed the method of mercurial injection, the tissue being subsequently rendered transparent by desiccation; a method which is still one of the most valuable for tracing these minute canals.

A modification of this method which is of value in the study of the lymphatics of an excised organ is illustrated in Fig. 2. The finely-drawn-out end of a glass tube, connected to a reservoir of mercury, is plunged into the tissue and the mercury allowed to run into the lymphatic vessels. A stereoscopic X-ray photograph is then taken of the whole organ, and a very beautiful demonstration of the lymphatics is obtained, standing out in bold relief when examined in the stereoscope.

LYMPHATIC GLANDS

At various points where the lymphatic vessels converge, collections of small rounded or oval bodies are found, which have received the name of Lymphatic Glands, and a close examination, especially in an

Fig. 2. Skiagram of lymphatic vessels, from the periphery of the breast, injected with mercury. Natural size.

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injected subject, reveals the presence of a communication between the lymphatic vessels and glands. A number of lymphatic vessels are seen to pierce one border of the gland where there is a distinct capsule, and a smaller number of rather larger vessels leave the substance of the lymphatic gland at a depression on the opposite surface known as the hilus.

If one of these lymphatic glands be removed, and a section of it taken passing through the hilus, it will be seen to consist of two portions surrounded by a definite fibrous capsule which contains a few muscular fibres, the outer or cortical portion being denser and darker in colour than the central or medullary portion. The cortex of the gland does not enclose the medulla completely, but tails off, and becomes thinned, as it approaches the hilus, where the medulla and the capsule come into intimate relationship. In stained sections of the gland, the cortical portion takes up the dye more intensely than the medulla, and appears to form a sort of horse-shoe around the more central portion. In old age the cortex becomes much diminished and is often broken up, suggesting that the function of the lymphatic gland is more important in early life.

The cortex appears to the naked eye as a uniform structure, but it is simple to demonstrate the fact that this is not so. A glass tube is drawn out to a fine point, and connected with a reservoir containing finely-ground Prussian blue by means of

a piece of india-rubber tubing. The pigment can be obtained very conveniently in the collapsible lead tubes which are sold for water-colour drawing. When the colour is flowing freely from the end of the glass tube, this is plunged just beneath the capsule of the gland. In a successful experiment a considerable amount of the injecting fluid passes into the gland, and may be seen to escape through the lymphatics at the hilus. If the glands are now hardened, and cut across, it will be easily demonstrated that the pigment has not passed uniformly through the gland, but has taken a fairly well-defined course through a series of channels, known as the Lymph Paths. The arrangement of these varies in the two portions of the gland. In the cortex there is a well-defined path, lying immediately beneath the capsule, and surrounding the whole gland, except at the hilus. From this peripheral channel branches are given off towards the centre of the gland, dividing the cortical substance into a number of masses shaped like wedges, with their bases toward the capsule. In the centre of the gland these branches are more irregularly arranged, forming a dense plexus, and collecting once more to form definite lymphatic channels which leave the gland at the hilus and are termed Efferent Lymphatics. If the fluid be injected with more force, it can be made to penetrate into the gland tissue between the lymph paths, demonstrating that the walls of this plexus of lymphatic

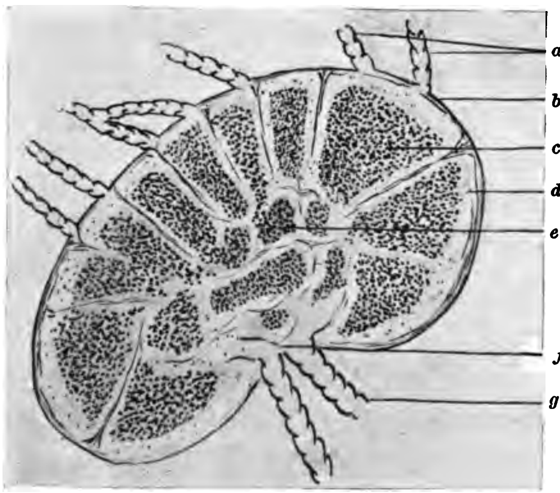

Fig. 3. Diagrammatic section of a lymphatic gland.
***a*, afferent lymphatics ; *b*, capsule ; *c*, cortical substance ; *d*, lymph path ; *e*, medulla ; *f*, hilus ; *g*, efferent lymphatics.**

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vessels are in open communication with the spaces between the cellular constituents of the lymphatic glands. A lymphatic gland is therefore a species of portal system upon the course of the lymphatic vessels, where the current of the lymph stream is slowed, and an opportunity is given for the abstraction of substances from the lymph, or for additions to it.

Between the branches of this lymph path are found cords of small round cells which consist almost entirely of a nucleus, the surrounding protoplasm being represented by an almost imperceptible film. These round cells, which closely resemble the form of granule-free cell found in the blood, where it is known as a lymphocyte, constitute the main bulk of the lymphatic glands; and by comparing the lymph before and after it has passed through the gland, it is easy to demonstrate that they have passed into the lymph stream, on their way to the blood. Scattered through the gland are numerous collections of rather larger cells, which are known as the Germinal Centres, and represent the source from which the lymph cell is derived. These germinal centres have a tendency to a concentric arrangement of their cells, and exhibit numerous mitoses. It can be seen that they divide, and by their divisions produce the lymphocytes which are found fully formed at their periphery. It is important to remember the presence of these collections of cells and their diffuse arrangement within the masses of

ordinary lymph cells, since they are liable to be mistaken for deposits of carcinoma. Carcinoma, however, is conveyed to lymphatic glands by lymphatic vessels, and a common site for an early deposit of a malignant disease is at some point in the lymph path rather than in the middle of a strand of cellular tissue. It is, however, not unusual to find these germinal centres especially well marked in cases of carcinoma, probably owing to the increased growth of the gland, which is produced by chronic inflammation, quite apart from the actual metastatic product. The supporting structure of the gland consists of a capsule which surrounds the cortex, and of septa bearing blood-vessels, which pass inwards towards the medulla between the various masses into which the cortex is divided. This fibrous stroma is connected with a reticular formation, which extends between the constituent cells of the gland. The exact nature of this reticulum is not definitely known, some authorities maintaining that it is composed of stellate cells united by the ends of their branches, while others maintain that it is a fibro-cellular network. In some situations small lymphatic nodules are supported by a very beautiful and delicate stroma which stains well by the silver chromate process. This is specially clearly seen in the case of the Malpighian corpuscles of the spleen.

The arteries, veins, and nerves enter the gland through the capsule. The blood-vessels pass in between

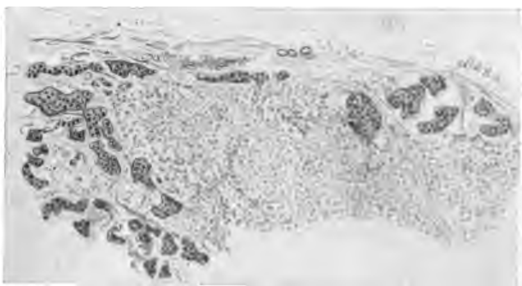

Fig. 4. Secondary deposit of cuboidal-celled carcinoma in a lymphatic gland. The cells of the carcinoma are seen in the lymph path beneath the capsule, extending inwards along the fibrous septa. Shrinkage of the cells, due to the alcohol with which the specimen was hardened, demonstrates the actual space in which these cells are lying.

Drawn with the camera lucida.

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the groups of lymphocytes, but only under exceptional circumstances do they actually open into the intercellular spaces. In some glands, however, this has been observed, an organ being produced with a structure intermediate between that of a lymphatic gland and the spleen. These receive the name of Haemolymph Glands. They are probably present in the adult man, but are more frequently found in some of the lower animals. After excision of the spleen they are still more commonly observed, and it is possible that they take on the functions of that organ vicariously.

The nervous supply of lymphatic glands is by means of non-medullated fibres, but their exact significance is uncertain. Some of them are probably vaso-motor in character, while others are nerves of supply to the unstriated muscular fibres which occur among the fibrous tissues in the skeletal structures of the gland.

The lymphatic glands undoubtedly play a very large part in the resistance of the body to disease; their situation at the junction of numerous lymphatic vessels, enables them to collect any organisms which may be circulating in the lymphatic stream, and to deal with them appropriately. This special bacterium-resisting mechanism is highly specialized and is only found among the higher animals. It is quite a late development in the evolution of the species, and in the life-history of the individual. In the lower

animals this function is carried on indiscriminately by the various organs of the body. In some of them the lymphatic and vascular systems are represented by an open coelomic cavity, and a very imperfect cardio-vascular mechanism. Among invertebrates lymphatic glands occur occasionally, but it is only in the higher reptiles that they begin to be constantly present. In man the lymphatic glands do not appear until about the fifth month.

Their exact method of origin is uncertain. The thymus gland, which is the great lymphatic structure of foetal and early extra-uterine life, is developed from the floor of the pharynx, and the epithelial cells in this situation have been described as sinking into the surrounding cellular tissue where their nuclei divide and pass out of the cell surrounded by a small amount of protoplasm, thus forming the primitive lymph corpuscles. The mass of epithelial cells, which produces lymph corpuscles in this manner, becomes the first germinal centre; and the cells thus produced, passing into the lymphatic vessels, collect at definite spots, and produce fresh lymphatic glands. If this theory is true, it is interesting to notice that the cells which play so large a part in the protection of the body from bacterial invasion are derived from cells of the layer which, from its position as a lining to the alimentary canal, is most exposed to the attacks of micro-organisms. It would seem, therefore, that, in the higher animal, cells

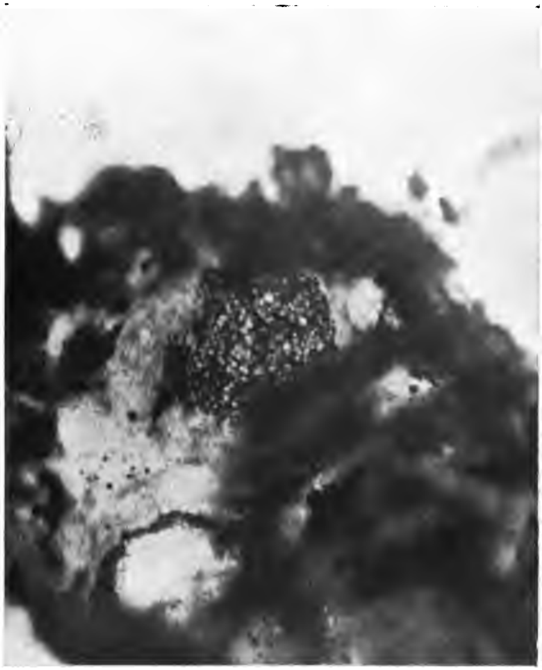

FIG. 5. The fine basket-work of connective tissue which forms the stroma of a malpighian corpuscle in the spleen. The irregular dark masses are due to diffuse staining.
Microphotograph of specimen stained by Golgi's method.

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which have originated from the pharyngeal epithelium pass into the deeper tissues, still retaining this among their previous functions, and constituting a second line of defence against organisms which have passed through the original epithelial layers. Other observers hold that the lymphatic glands are developed from mesoblast.

CHAPTER II

THE ANATOMY OF THE GROUPS OF GLANDS WHICH ARE AMENABLE TO LOCAL TREATMENT

For clinical purposes the glands of the head and neck may be subdivided into several groups, corresponding to the various sources of infection which are commonly met with. This division, however, does not correspond strictly to the anatomical classification.

FIRST GROUP: THE OCCIPITAL GLANDS

These are situated at the upper part of the posterior triangle, over the attachment of the trapezius and complexus muscles; they receive their lymph from the scalp, and on the efferent side are in communication with the deep cervical chain.

SECOND GROUP: THE GLANDS AROUND THE PINNA OF THE EAR

This group includes the *mastoid glands*, which are situated over the tip of the mastoid process. When, as in children, this process is absent, the glands lie at a

distinctly lower level than the temporal bone, over the sterno-mastoid muscle. They receive lymph from the scalp in the immediate vicinity, and from the pinna. The efferent lymphatics not only pass into the deep cervical chain, but also empty into the upper members of the superficial set, of which indeed they form a part.

The prae-auricular gland. This gland is situated just in front of the tragus and forms the superficial member of the *parotid group* of glands, the deep members of which are embedded in the gland substance itself, along the branches of the external carotid artery. The deeper glands are of very little surgical importance, but the prae-auricular gland is very frequently enlarged and is also a common seat of abscess formation. It receives its lymphatics from the parotid gland itself, from the upper part of the face, and in common with the mastoid gland it receives lymph from the pinna. It is consequently frequently affected from small abrasions or intertrigo in this region. Below the ear, and frequently enlarged in affections of this organ, are certain glands which, although they belong to the upper part of the deep cervical set, are very commonly affected in disease of the deeper part of the middle ear and antrum, especially in tuberculosis.

THIRD GROUP: THE SUB-MENTAL GLANDS

These glands are situated on the surface of the mylohyoid muscle between the anterior bellies of the digastrics. They receive their lymph from the lower lip and the front of the floor of the mouth, and communicate with the deep cervical chain.

FOURTH GROUP

In the submaxillary region the glands are mainly deep to the cervical fascia, but occasionally a few superficial glands are met with.

They receive lymph from the side of the tongue and floor of the mouth, the outer part of the lower lip, the upper lip, and side of the nose.

These efferent lymphatics join the deep cervical glands about the level of the bifurcation of the carotid artery.

FIFTH GROUP: THE GLANDS AT THE SIDE OF THE NECK

This large and important group is divided into two, a superficial and a deep set. The *superficial glands* are situated along the course of the external jugular vein; they are in relation above to the glands immediately below the ear, and below discharge their lymph either into the deep cervical chain or into the supraclavicular glands. The *deep set* lie along the course of the internal jugular vein and carotid artery, their

relationship being more intimate with the vein and the anterior part of the carotid sheath. They are traversed above by the spinal accessory nerve, which lies in a sheath of connective tissue of its own. This nerve divides the glands into two sets, the upper of which is very intimately adherent to that portion of the cervical fascia which is attached to the transverse process of the atlas vertebra. These deep cervical glands receive ultimately the whole of the lymph from the side of the head and neck, and their efferent lymphatics unite below to open into the thoracic duct or the right lymphatic duct. They receive their lymph from the nasal, buccal, and naso-pharyngeal cavities; and as these are the commonest points at which infective organisms enter the body, these glands are extremely commonly affected.

SIXTH GROUP: THE RETRO-PHARYNGEAL GLANDS

These are in immediate relationship with the anterior members of the previous group; they are situated between the wall of the pharynx and the prae-vertebral muscles; they derive their lymph from the pharynx, and discharge it into the deep cervical glands.

SEVENTH GROUP: GLANDS OF THE POSTERIOR TRIANGLE

These glands are a continuation of the occipital glands downwards; they form a continuous chain

under cover of the trapezius muscle, and at the lower part of the posterior triangle join the ***supra-clavicular*** glands, which are the meeting-place between the lymphatics of the neck and of the axilla. These pour their lymph, in conjunction with the deep cervical glands, directly into the thoracic duct or, on the right side, into the right lymphatic duct.

Besides these glands there are numerous glands scattered about in other regions; for example, there are glands in the face itself along the facial vein; a gland is also described at the ala of the nose, and there are the ***prae-tracheal*** glands, more constant in position, situated along the front of the trachea. The ***sub-lingual*** glands are some small nodules of lymphoid tissue on the course of the lymphatics of the tongue as they pass to the submaxillary group. The deep lymphatics of the maxillary region are situated in the pterygo-maxillary fossa over the attachment of the external pterygoid muscle.

The exact distribution of lymphatic glands in other parts of the body is not so important for surgical purposes, but there are two regions in which a knowledge of their anatomical relationships is of value.

In the arm the lymphatic vessels follow the veins to a great extent, and although there are small knots of lymphoid tissue upon their course, there are no glands of any size below the elbow. The supra-condylar gland, which is situated about two inches above the

internal condyle of the humerus, is occasionally enlarged; but it seems to lie out of the main stream of lymph from the hand and fore-arm, and in consequence is only rarely enlarged in acute sepsis of these regions. In diseases where there is a generalized infection which causes enlargement of the lymphatic glands, it is often involved. For example, it is affected fairly constantly in secondary syphilis. The axillary glands, which lie among the fat in this space, receive the lymph not only from the arm, but also from the front of the thorax and abdomen. They have been divided into three main groups, namely, a set along the veins coming from the arm; a set along the lower border of the pectoralis minor accompanying the external mammary veins; and a set in relationship with the sub-scapular vessels. Besides these, it is important, especially in malignant disease of the region, to remember the presence of one or two glands in intimate relationship with the costo-coracoid membrane. The efferent lymphatics from the axillary glands pass up under the clavicle, in front of the great veins, and join the lymphatic glands and vessels in the posterior triangle of the neck.

The lymphatics of the lower extremity, like those of the arm, run in intimate relationship with the veins. There are a few lymphatic glands in the popliteal space, and occasionally a small anterior tibial gland in front of the interosseous membrane near the point

where this structure is pierced by the anterior tibial artery. These glands are in intimate relationship with the deep structures, and do not derive lymph to any great extent from the skin and subcutaneous tissue of the leg. The superficial lymphatics run in an almost unbroken course to the inguinal region, where there is a large and irregular group of glands. An attempt has been made to classify these glands into groups, but exact anatomical classification has been impossible, owing to the free anastomosis between the lymphatics, and the irregular arrangement of the glands. Clinically, however, the old classification into an inguinal and femoral set is of value, although too much stress cannot be laid upon it. These glands receive lymph not only from the leg but from the lower part of the abdomen, the buttock, perineum, and the external genitalia. In affections of the leg itself it is common to find the enlargement consisting of a swelling situated over the course of the femoral vein, whereas in infections derived from the perineum the glands higher up tend to enlarge and the swelling lies along Poupart's ligament. The constancy of this is, however, not sufficient to afford any definite information as to the exact site of the exciting lesion, although it may give a slight hint. In all cases of enlargement of the glands in the groin the whole of the tributary area must be examined.

CHAPTER III

THE DIAGNOSIS OF GLANDULAR ENLARGEMENTS

It is only occasionally that the diagnosis of a glandular tumour presents any great difficulty, that is to say, as far as the determination of its glandular character is concerned; although it may be a matter of the greatest difficulty to determine the exact cause of the glandular enlargement.

The difficulties met with vary in different regions of the body. Lymphatic glands are arranged in definite groups or chains, and the enlargement of a single gland is uncommon, so that a glandular tumour almost invariably consists of a mass of smaller nodules more or less welded together. The enlargement is generally more marked at one point of the chain, especially where two sets of lymphatics join; for example, in the inguinal region the glands most commonly and most acutely affected are those at the junction of the femoral and inguinal sets.

When a nodular tumour occurs in the course of a chain of lymphatic glands, with a line of smaller tumours running along the line of those glands, the

diagnosis is at once apparent. Some forms of myxo-fibroma do form similar chains, but these cases are very uncommon. Enlargements along the course of nerve trunks—neuro-fibromata—only very rarely cause any difficulty, although a case was once observed of a myxo-fibroma of the cervical sympathetic which it was impossible to distinguish from a glandular tumour. There are, however, certain types of glandular tumours which present difficulties of diagnosis. Although it is perfectly true that in glandular enlargements there is usually a chain of glands present, it may be impossible to diagnose this before an operation, and when in addition the enlarged glands have fused into a uniformly smooth mass the physical signs of the tumour may be equivocal.

In the neck the common difficulties met with in various regions may be briefly described. In the glands around the ear there are several fallacies which must be avoided. Over the mastoid process there is a small lymphatic gland which is frequently enlarged, and often suggests at first sight mastoid disease. When the gland has broken down and become simply an abscess cavity, the diagnosis may be difficult, but the absence of signs of middle-ear disease, and of oedema of the upper and posterior walls of the external auditory meatus, combined with the absence of the constitutional disturbance which accompanies mastoid disease, usually leave little doubt as to the diagnosis. Before the

gland has actually broken down, its exact anatomical relationships can be more easily determined, and the swelling, though it may be acutely tender and painful, can with a little manipulation be made to move slightly on the underlying bone, showing that the inflammation has originated superficially to the periosteum. The gland, moreover, is situated more towards the apex of the mastoid process than a swelling due to mastoid suppuration, the maximum point of intensity of which is situated over McEwen's triangle.

In the parotid region, it is sometimes difficult to diagnose between an enlarged gland and a simple tumour of the parotid. The gland in this situation which is most commonly enlarged is the gland immediately in front of, and below the tragus; whereas parotid tumours may be situated in any part of the gland. It is usually possible to demonstrate that the parotid tumour lies deeper than an enlarged gland, that is to say, it is situated beneath the deep fascia. This fact is of value, inasmuch as the common diagnostic difficulty is the distinction between a parotid tumour and a lymphatic gland belonging to the superficial set. Parotid tumours usually have a much longer history than enlarged glands, increasing in size slowly and steadily for many years.

In the neck, cystic swellings of congenital origin are frequently met with, which at first sight simulate glandular abscesses; but their walls are smoother, their

texture is more regular, there is no chain of smaller glands extending from them, and their mobility is much greater than would be found in an abscess of a similar size.

Tumours in the sterno-mastoid muscle are sometimes mistaken for glands, but the diagnosis becomes at once apparent when the exact situation of the swelling is determined; glandular tumours not being found within the substance of the muscle itself. Moreover, sterno-mastoid tumours are found in new-born children, an age when enlarged glands are very rarely met with.

In the sub-maxillary region, especially in association with cases of salivary calculus, the salivary gland is often enlarged, resembling a glandular tumour of this region. The diagnosis in this case is especially difficult, inasmuch as the surrounding lymphatic glands are usually enlarged as well. The affection of the salivary gland is usually accompanied by swelling along the side of the floor of the mouth, caused by an inflammation around the salivary duct, which lies in such close relationship to the mucous membrane of the mouth, that any swelling is readily apparent.

Adenomata of the thyroid gland occasionally suggest glandular tumours. This occurs especially when the enlargement is restricted to the upper part of one lateral lobe, or to an accessory thyroid; it is not common, however, to find such a tumour apart from

enlargement of the rest of the thyroid, although this may be slight.

The attachment of the capsule of the thyroid to the prae-tracheal fascia, and hence to the trachea, causes the tumour to move distinctly on swallowing; this does not occur in the case of lymphatic glands, the fascia around which is attached to the carotid sheath rather than to the fascia of the trachea. With the exception of tumours of the sterno-mastoid muscle, the diagnosis is of small practical importance, as all the other tumours require surgical interference, and their removal is conducted on precisely similar lines.

In the abdominal cavity, glandular tumours frequently present very perplexing physical signs. The commonest glandular tumours which can be diagnosed as such are those associated with tuberculous disease. These form an irregular nodular mass, usually situated on the posterior abdominal wall around the root of the mesentery. These cases are most commonly met with in children, and a rectal examination is often of the very greatest value in clearing up the diagnosis. In children it is quite possible to reach above the rim of the pelvis by this means, especially under an anaesthetic, and thus to determine the nature and relationship of the tumour. In adults a series of malignant deposits in the omentum, or on the parietal peritoneum, often resemble lymphatic enlargements, and it may be

impossible to arrive at a definite diagnosis without making an exploratory incision. In many cases, on the other hand, the accompanying symptoms leave no doubt as to the true nature of the tumour.

The position in which an enlarged gland may present the most extreme diagnostic difficulties is in the region of the femoral canal. When the symptoms of femoral hernia are well developed—when, that is to say, there is a tumour which has an impulse on coughing, and reduces with a gurgle, there is no temptation to confound this with an enlarged lymphatic gland. But it often occurs that the femoral hernia contains no bowel, but simply a nodule of omentum surrounded by a mass of condensed retro-peritoneal fat, the whole forming a mobile tumour about the size of a small walnut, and in these cases the differential diagnosis may be very difficult. A femoral hernia is, however, a structure with deep attachments passing through the fascia lata; and an enlarged lymphatic gland is entirely superficial to this structure; in consequence, although the femoral hernia can be freely moved in most directions, yet at one point, where its pedicle comes through the saphenous opening, this is not possible; the fixation to the femoral ring preventing the surgeon lifting the swelling from the surface of the fascia. If this fact be borne in mind it will usually be possible to make a correct diagnosis.

THE DIFFERENTIAL DIAGNOSIS OF GLANDULAR TUMOURS

In attempting to arrive at the diagnosis of the exact nature of a glandular tumour, the consideration of its duration affords important help, dividing the cases into the two great groups of acute and chronic enlargement. If the enlargement has only been present a few days, and there is a considerable amount of periadenitis, the case is in all probability one of acute adenitis, and search should be made for the source of the infection.

There are two sources of error which must be carefully considered. In the case of tuberculous glands, an acute suppurative process sometimes supervenes upon the original infection; and in consequence the swelling, which previously had attracted but little notice, suddenly becomes very marked, suggesting the presence of a simple acute abscess, which is accordingly incised. The wound, however, remains open and refuses to cicatrize, its edge becomes undermined and covered with unhealthy granulations, proving that there is some additional infective agency at work.

A similar process also occurs in some types of malignant disease, necrosis of which is often accompanied by such rapid increase in the size of the gland that it is quite easily mistaken for an acute suppuration. In some cases of sarcoma, especially lympho-sarcoma, the rate of growth is so extremely rapid, and the

disease so diffuse, that a clinical picture is presented which strongly resembles an acute abscess. In both of these, however, the rate of growth is slower than an acute abscess, is not accompanied with the same febrile disturbance (unless suppuration has actually supervened); and is associated in the case of lymphosarcoma with marked cachexia. The presence also of a primary growth in the region drained by the affected group of glands often, of course, clears up all difficulties of diagnosis. While in these patients mistakes can readily be made by examining merely the affected glands, yet if the general condition is considered, and the examination conducted more thoroughly, an accurate diagnosis will generally be possible.

It must be borne in mind that in the acute specific fevers there is very frequently marked enlargement of the cervical glands; this is usually due, not to the specific fever itself, but to the infection of the fauces by ordinary septic organisms which accompany the specific infection. The glandular enlargement is frequently the symptom which first attracts the notice of the patient, or the patient's friends, and the possibility of an acute glandular affection being associated with one of the specific infective fevers should always be most carefully borne in mind.

When the history of glandular enlargement is of longer duration, extending over a period of weeks, months, or even years, the diagnosis becomes more

difficult, and the cases fall, from a clinical point of view, into three big groups. The first group contains those types of glandular enlargement which are due to a chronic infective process: for example, tuberculosis. In the second are placed the glandular enlargements due to malignant disease either primary or secondary: for example, carcinoma. The third group comprises enlargements which are due to constitutional disease, such as leukaemia. The diagnosis between these three groups is of great importance, since in the first two groups the surgeon has to deal with a disease which is derived from a local infection, and which is amenable to local treatment; in the third, he is dealing with more profound constitutional disturbance, which requires to be met in an entirely different manner.

In the chronic simple inflammations occurring in connexion with caries of the teeth, catarrh of the pharynx or intestinal canal, and secondary anaemias, without the discovery of the exciting focus, it is usually impossible to be sure of the exact nature of the disease. Careful observation of the progress of the case will usually clear up the diagnosis.

When there are larger masses of glands the individual members of which still remain distinct from each other, the question arises whether such diseases as lymphadenoma and leukaemia are present, although it must be admitted that some cases of tuberculosis

are accompanied by the presence of very large discrete glands.

The next point to be considered is the relationship of the glandular tumour to the surrounding structure. To determine this in a case of cervical glandular enlargement, the surgeon stands behind the patient, who is seated in a chair. Both sides of the neck can now be carefully examined and compared, the head being flexed or turned to one or other side so as to relax the muscles. Thus, if there is a mass of glands upon the right side, lateral flexion of the head to the right side while the face is turned upwards and to the left will relax the sterno-mastoid muscle, and enable the surgeon to ascertain the degree of fixation to the deeper structures. When the glands are beneath the sterno-mastoid, they are often so bound down by the muscle that they appear at first sight to be fixed to the deeper structures. When, however, the muscle is relaxed, the false fixation entirely disappears.

The muscle should next be thrown into action by making the patient turn the head to the unaffected side while the surgeon resists the movement. It is quite easy to do this, when the patient is examined in the manner just described. If the mass is on the right side the surgeon orders the patient to turn his face to the left, inclining his head to the right, resisting the movement by placing his left hand on the patient's forehead and holding the head firmly against his own

thorax. This leaves the right hand free for examination of the tumour.

Fixation to this muscle is not a sign of any grave import, as many non-malignant tumours are fixed to the sterno-mastoid. It, however, is a valuable point to be borne in mind by the operator, as it will certainly render the operation more difficult.

The adhesion is usually to the anterior border of the muscle, but it is very rare for it to be so intimate as to demand the sacrifice of more than a few of its anterior fibres.

The value of such a method of examination is well seen in this region of the body; thus in a case with a large mass of enlarged glands, if the glands are separate from each other and not fixed to surrounding structures, the most probable diagnosis is lymphadenoma. If the glands are fixed to each other, but not to the deep structures, they are probably tuberculous. Fixity to each other and to the deep structures is, however, highly suggestive of malignant disease.

The relationship of the mass to the great vessels should be determined, but it must be confessed that it is not possible to gain any great help in diagnosis in this way. The glands are usually superficial to the great vessels, and do not displace them in the way that a thyroid tumour does. It is consequently not easy to determine whether the vessels run through or beneath the mass.

Although the patient may only complain of enlarged glands in one region of the body, the investigation should not be restricted to this area, but all accessible glands should be examined. In addition to this, the abdomen should be examined, to ascertain whether the liver and spleen are enlarged, and if there is any abdominal tumour suggestive of tuberculous or malignant disease.

This extensive examination often seems, to the patient, unnecessarily searching, and is sometimes resented, but its necessity cannot be too strongly insisted upon in all cases of chronic glandular enlargement. Its omission often leads the surgeon to carry out methods of treatment which are unsuitable for the case, while its routine performance clears up the diagnosis in many difficult cases. Thus tuberculosis tends to commence in one set of glands and spread gradually to other groups, after a considerable lapse of time. There are some cases, of tuberculosis, in which the glandular enlargement is diffuse from the beginning, and this tuberculous lymphadenitis presents many difficulties of diagnosis, some cases being indistinguishable from lymphadenoma without a microscopical examination of the glands. The distribution of the glandular infection is important, not only from the point of view of diagnosis, but also from the point of view of prognosis.

It is a good plan, in all cases where glands are

removed, to take advantage of the relaxation afforded by the anaesthetic to examine the patient's abdomen, with a view to ascertaining the presence or absence of enlargement of the mesenteric glands, a point which it is very difficult to make out without this assistance.

Pronounced glandular enlargement with an enlarged spleen is practically always due, either to lymphadenoma or to leukaemia. When splenic enlargement is present a blood examination should always be made, the blood change in leukaemia being so marked, and so characteristic, that the presence or absence of this disease can be determined with certainty.

In some cases of generalized tuberculosis the spleen is enlarged, but this is never so marked as in the case of leukaemia and lymphadenoma. In children also the spleen is often enlarged as a result of intestinal disorders, and in association with rickets, the possibility of which must be borne in mind. The spleen may, of course, be enlarged as a result of some pathological condition quite distinct from that which gave rise to the glandular enlargement. A correct diagnosis will, however, be generally possible if the whole of the symptoms and physical signs are investigated.

It may often happen that the attention of the surgeon has been called to some primary focus of infection, either inflammatory or malignant. In all cases, however, the region from which the glands under consideration derive their lymph should be examined.

CHAPTER IV

CELLULITIS

When, owing to a breach in the surface epithelium, micro-organisms find their way into the body, they lie in the interspaces between the cellular constituents of the tissues. These spaces are in intimate relationship with the commencement of the lymphatic system, even if they are not in actual open continuity with them. It is in these intercommunicating spaces and lymphatic channels that the infective material travels to other parts of the body. Owing to inflammatory processes taking place around the infected spot, a localized effusion of fluid is produced giving rise to swelling and oedema. If the infective process is confined to a restricted area, the inflammation may either subside altogether or a localized abscess may be formed. If this local restriction does not occur, the infective process spreads rapidly, the organisms find their way into the blood stream, and symptoms of septicaemia may supervene. More commonly, the spread takes place by means of the lymphatic vessels and intercellular spaces. Although the local disease-resisting mechanism may be quite competent to cope with the

local infection, the organisms may none the less spread into the lymphatic trunks, along which they travel until they arrive at the lymphatic glands, where they produce all the symptoms of acute adenitis. In such cases there is no affection of the lymphatic vessels themselves, the organisms travelling along them quite passively. In the more acute inflammations, that is to say, when the virulence of the organisms is great or the resistance of the patient to infection exceptionally low, the passage of the infective material along the lymphatics is marked by acute inflammatory changes in their wall. Clinically these appear as red lines running from the infected focus towards the nearest lymphatic gland. The edges of these lines are not very sharply defined, but in a well-marked case it is possible to feel the inflamed lymphatic as an irregular hard cord, which is both painful and tender. This is perhaps seen in its most marked degree in cases where there is an acute infection of the glans penis; here it is often possible to feel the dorsal lymphatic as a definite hard cord, running up the organ to the symphysis. This condition is known as *Acute Lymphangitis.*

It occasionally happens that at certain points along these lines of inflammation the infective process is specially acute, and an inflammatory mass is formed which suppurates and runs the course of an ordinary acute abscess.

In other cases the inflammatory process is not con-

fined to any definite anatomical structure, but spreads out in all directions in the intercellular spaces, which become widened out into broad cavities containing pus, running in all directions and undermining the skin. This is called *Cellulitis.* The pus may rupture into adjacent cavities, such as tendon sheaths, bursae, or even into joints. Rupture into joints fortunately is not a common occurrence, but when there is an acute cellulitis of this nature in the neighbourhood of a large joint it is common to find fluid in the synovial cavity, which disappears as soon as the cellulitis has come to an end, without calling for any operative interference with the joint. Occasionally, when the wound contains the Streptococcus pyogenes, the infective process spreads in the lymphatic vessels of the skin itself, producing the inflammatory condition termed Erysipelas, which is described more fully in another section. A condition allied to erysipelas is often met with springing from an infected focus, which is probably intermediate between cellulitis and true erysipelas; its outlines are less defined, and there is not the same severe constitutional disturbance as in the latter disease. This is most commonly met with in acute exacerbations of chronic sepsis, such, for example, as an indolent ulcer of the leg.

The cellular tissue beneath the lower jaw is occasionally the seat of a severe type of cellulitis, usually streptococcal in origin. This has received the name

of *Ludwig's Angina*, but there is no definite and sharp distinction between it and other varieties of cellulitis. It frequently spreads backwards involving the root of the tongue and the larynx. Oedema glottidis not infrequently follows producing acute respiratory obstruction. The constitutional disturbance is severe, and a large percentage of the cases end fatally.

TREATMENT

The problem presented to the surgeon is that of overcoming an acute infection, and to this end his attention must be directed not only to the infecting organism, but also to the resisting patient. It is doubtful whether, in an acute infection, any process which has yet been devised has a specific action on the bacteria which lie among the patient's tissues. The object of antiseptics and antiseptic dressings in such cases is to prevent the multiplication of organisms in the discharges, and to oppose a barrier to the ingress of fresh infection. It is probable that even the most potent germicidal solution has little or no effect upon the organisms which lie actually within the tissues, inasmuch as these are usually at a considerable depth from the surface, and could not be reached by the antiseptic solution without destruction of the surrounding tissue.

The body is stimulated to its maximum resistance, by all the means in the surgeon's power. One of the

most important is rest, which has not only the generalized action of rest upon an inflamed or painful part, but in the case of the lymphatics a specific one also. It must be remembered that when a limb is completely at rest there is no lymph-flow in the great lymphatic trunks, this occurring only when the limb is moved or massaged, so that, by preventing the lymph-flow from washing organisms into other parts of the body, rest aids materially in localizing the infective process. In the superficial variety, painting with 25 % solution of Ichthyol is often a method of very great value.

While it is still uncertain whether suppuration will ensue or not, much relief is obtained by the application of hot fomentations or poultices, which should be applied frequently, and a careful watch set for the onset of suppuration. This is usually indicated by an increase in the severity of the local and constitutional symptoms, although, when the suppurative process is definitely established, it is not uncommon to find the patient's condition rather improved.

It is not necessary, however, to wait for definite evidences of suppuration, such as fluctuation and atrophy of the skin, but in cases where the infective process does not rapidly subside, it is good practice to make a series of free incisions so as to let out the infected serous fluid, which lies in the intercellular spaces. These are best made in the long axis of the limb, if that is the site of the infection, or in other parts

of the body along the lines of cleavage of the skin, so as to make the most satisfactory scar when healing is completed. If pus is discovered, provision must be made for adequate drainage, and the skin should be undermined around the incisions by thrusting blunt-pointed sinus forceps in all directions, so as to throw the numerous smaller cavities which contain pus into communication with each other and with the wound. All such operations must be carried out with the strictest regard to asepsis. This is a point which is always insisted upon in the literature of acute inflammation, but is very commonly disregarded in actual practice. It is said that 'the case is so septic that a few organisms added to the countless millions which are already present can make no difference'. This doctrine is, however, neither sound in theory nor trustworthy in practice. If micro-organisms are admitted into a fresh wound, suppuration follows and the healing of the wound is retarded, so that there is no doubt whatever as to the amount of mischief caused by the infection. When fresh organisms are admitted into a wound that is already infected, exactly the same process takes place, but the presence of the original infection masks the effect of that which is introduced secondarily, and hence its evil results are overlooked. After the incisions have been made and the pus let out, any loose sloughs are removed and drainage provided for by means of india-rubber tubes or by packing. The

remarks made on the use of packing in acute glandular abscesses apply with equal force in cellulitis. When efficient drainage is provided the next dressing is an ordinary antiseptic dressing composed of double cyanide gauze, wrung out of a 1 in 4,000 solution of perchloride of mercury, and it is often a relief to the patient to apply this dressing as hot as can be conveniently borne, thereby gaining the advantages of both poultice and antiseptic dressing.

If the part is very brawny and painful, and the suppurating tracks not definitely formed, continuous irrigation is often of the greatest value. This is best performed by supporting a vessel containing the irrigating fluid a short distance above the wound; a long wisp of gauze is then taken, one end of which is dipped into the fluid, and the other laid in contact with the wound. A syphon is thus formed which acts by capillarity, keeping the irrigating fluid continuously flowing over the wound. The fluid as it escapes is caught in a mackintosh, so arranged as to form a gutter diverting it into a convenient receptacle. Intermittent antiseptic baths are also much used, and seem to be valuable. The irrigating or bathing fluid should be a mild antiseptic, and one which does not coagulate albumen; the most commonly employed are boracic acid and permanganate of potash. Both these methods have, however, one objection, namely, that it is very difficult to prevent re-infection. Especially is this the

case in the arm and leg baths, which are so commonly used. These are often made of painted tin, are partially covered, and are often used indiscriminately for all sorts of septic cases; they are filled, it is true, with an antiseptic solution, but this is always a weak one, so that it is difficult to see how the conditions demanded by an antiseptic treatment can be fulfilled. On the whole, it will be found that the cases which do better with any treatment other than a rigidly antiseptic dressing, and free drainage, are very few and far between.

In addition to the local treatment, constitutional treatment should be vigorously carried on. The old-fashioned remedy of the tincture of the perchloride of iron, given in doses of 20 to 30 minims, three or four times a day, is extremely valuable, but care must be taken to keep the bowels acting freely, preferably by the administration of a saline aperient. The diet should be as generous as the patient can digest, and as far as possible he should be kept in the fresh air.

When the symptoms of septic absorption are very marked, the patient may derive considerable benefit from some of the anti-toxic sera, and if serum prepared with the same organism which is present in the wound can be obtained, very remarkable results often follow. To ensure this as far as possible, a polyvalent serum prepared from a number of different strains of cocci should be employed. The dosage of this is usually

supplied by the makers, but as a rule, from 5 to 20 cubic centimetres are injected at a time, and the injection repeated daily. If administration of the serum is followed by a fall in the temperature and improvement in the patient's condition, its use should be continued, but if no benefit is being derived it should be abandoned. Anti-toxic sera are by no means innocuous, as they may produce rashes, and severe joint pains, which tell considerably upon the patient's constitution. In this connexion it is worth noting that in some cases where hypodermic injections of morphia have given no relief to the joint pains, a rectal injection containing a drachm of laudanum, and a little raw starch, has been completely successful in relieving the patient.

In cases of cervical cellulitis (Ludwig's angina) a careful watch must be kept for symptoms of laryngeal obstruction. This complication usually requires tracheotomy, an operation which is often rendered exceedingly difficult by the swelling of the tissues in front of the trachea.

When cicatrization is completed, there is often a certain amount of solid oedema left permanently, a description of which is given in another section.

CHAPTER V

ERYSIPELAS

This disease is produced by the invasion of the lymphatics of the skin by the Streptococcus pyogenes. For a considerable time there was a great doubt as to whether this condition was produced by Streptococcus pyogenes, or by a specific organism which received the name of Streptococcus erysipelatus. Most of the more recent workers at this subject agree, however, that erysipelas is merely a manifestation of streptococcus infection, and that the same organism may produce a number of other diseases, for example, puerperal fever, peritonitis, and panophthalmitis.

On this view of the etiology of the disease, it would seem that erysipelas would always follow some break in the epithelial covering of the body, or in the mucous membrane, although there would be no necessity for the existence of a large wound. Cases certainly occur in which the wound cannot be discovered, but in these cases it is probably exceedingly small, such as would be made by the sting of an insect, or it may have healed before the onset of the disease.

Erysipelas frequently starts at the junction of cuta-

neous with mucous surfaces, a region of the body which is specially liable to cracks and fissures.

Two main varieties of this disease occur. In the first there is an open septic wound from which the skin may be infected secondarily. These cases occur in any part of the body, very commonly in the leg, where the presence of a chronic ulcer affords a point of entry for the infecting organism. In the pre-antiseptic days it was a very common occurrence after surgical operations. In the second group there is no gross lesion, and in these cases the disease occurs most commonly in the face. In children it occurs also around the vulva, and in new-born babies around the umbilical cord.

There is of course no true difference between these two varieties, the organism being the same in each case, but in the first variety the general sepsis obscures the definite erysipelatous affection, and it is often hard to tell whether there is a true erysipelas present, or merely the reddening of the skin over a superficial cellulitis.

In cases of deep-seated abscesses containing the Streptococcus pyogenes, opening the abscess may introduce the organism into the superficial lymphatics and produce true erysipelas around the incision.

The disease is distinctly contagious, the organisms existing in abundance in the discharge from the wounds, or, in cases where the wound is very small, in the epithelial scales or dried-up contents of the bullae

which very commonly form over the affected area. The organism may also hang about bedding or other articles which have been in contact with the patient, and infect any other person who uses them.

Although erysipelas is merely a skin infection with streptococci, the disease is rather on a different plane from acute abscess or cellulitis, ranking rather with the specific infective fevers than with simple infective disorders. Thus it affects females three times as frequently as males, is commoner in spring and autumn than in summer and winter, and sometimes takes on an epidemic form. In the pre-antiseptic days it was much commoner than at the present time, and the surgical wards of the hospitals were frequently decimated by disastrous epidemics, the patients being infected from each other, from instruments or the furniture of the ward, and from their medical attendants. Under modern surgical conditions this never occurs.

The typical signs and symptoms of the disease usually begin to manifest themselves from thirty-six to forty-eight hours after infection, although the period of invasion is sometimes as short as fifteen hours. Rigors are often present in the early stage before the typical rash appears, but the onset in a few cases is afebrile. The constitutional symptoms vary in severity, from slight malaise to the most profound toxaemia, with fever or even hyperpyrexia, vomiting, headache, delirium, and signs of cardiac weakness. These reach their height

about forty-eight hours after the onset, and then as a rule subside. There is, however, nothing in the general condition of the patient which is specially characteristic, the symptoms being those common to all severe infections.

The local condition is, however, characteristic, and in a well-marked case quite unmistakable. The area involved is red, swollen, and painful, there is a superficial oedema which is most marked in situations where the skin is loose, such as the eye-lids. Where the skin is more bound down, for example, on the cheeks, the red area is smooth and shiny. Over the affected parts small blebs form, containing a clear, serous fluid. In some cases the infection is so severe that there is actual necrosis or gangrene of a portion of the skin.

The red area tends to spread, and at its edge there is a well-defined, raised line of demarcation, between the healthy and affected portion. There are occasionally outlying portions which are sometimes connected with the main part by thin red lines.

The spread takes place most readily along the lines of cleavage of the skin. This is due to the arrangement of the bundles of connective tissue fibres which run to a large extent parallel to the lines of cleavage, leaving spaces between these which consequently have the same direction. It is in these spaces that the organisms spread. When the edge is examined micro-

scopically an intense round-celled infiltration is found, especially around the lymphatic vessels, many of which are plugged by masses of streptococci.

The neighbouring lymphatic glands are enlarged and tender, especially when the disease is produced by a spread of the infection from a wound of some size.

After a week or ten days the temperature usually abates, and the local symptoms disappear, but fatal cases are not uncommon. In these the disease continues to extend and may involve the whole body, the temperature rises, the toxaemic symptoms become more and more marked, and the patient succumbs to exhaustion. After death a further rise of temperature is often to be observed. In severe cases which do not end fatally the local lesion is often very extensive, the spread advancing as a red zone from place to place, over a large part of the body, the portion of the skin behind this regaining its normal character. This is sometimes so marked that the term *Erysipelas migrans* is applied to the condition.

Relapses are common: the spread of the disease ceasing and the patient's general condition ameliorating; then, after a period of quiescence, the temperature again rises and the local rash reappears. One attack of erysipelas does not confer immunity, some patients being specially liable to the disease, and passing through twenty or more attacks. In some women after the menopause, these come on every month, replacing as it

were the usual menstrual epochs—the so-called *Katamenial erysipelas.*

Erysipelas attacks mucous membranes either primarily or by spreading from the contiguous skin surface. These cases are often of great severity, the constitutional symptoms being much more severe than in purely cutaneous lesions. Recovery is still the rule in these cases, but a small percentage end fatally, the most dangerous being those in which the disease affects the larynx and surrounding structures.

The general rule is for the disease to leave no traces locally, but occasionally marked changes remain in the part which has been affected. In some cases, after facial erysipelas, the complexion is improved, the small chronic septic foci which so commonly occur being completely eradicated, and the general texture of the skin made softer and finer. In other cases there is chronic lymph stasis, the features remain swollen and the skin coarsened. When there has been a considerable amount of oedema, as in the lower eye-lid, a semitransparent alabaster-like mass remains, either permanently, or at least for a considerable time. This oedema is solid, and does not pit on pressure to any great extent.

TREATMENT

In the slight cases, treatment does not seem to accelerate recovery to any great extent, and it is often

sufficient to protect the skin surfaces with a light pad of wool, keeping the patient at rest in bed. Many of the habitual cases come under this rule, the patient becoming so accustomed to the disease that he takes little or no notice of it.

For cases beyond these very slight ones, treatment is of value and consists of:—

1. *Local.* The drug which is of most value is Ichthyol, which is applied in the form of a 25% solution to the affected area. Pain is speedily reduced, the reddening diminishes, and in most cases satisfactory recovery is obtained. Evaporating lead lotion, calamine lotion and other similar preparations, are often employed, but their efficacy is far below that of ichthyol.

Attempts have been made to check the spread of the disease by setting up a superficial irritation and consequent leucocytosis, around the affected area and at a short distance from its margin. This is done either by painting a line of iodine about half an inch from the growing margin, or by making superficial scarifications. Filling the lymph spaces in this way with cells whose function is to resist the invasions of micro-organisms is quite a rational method of procedure, and good results are reported from its employment.

2. *General.* The patient is treated for a febrile disturbance. He is kept in bed, the bowels are kept acting, and an easily digested, nutritious diet given. Perchloride of iron in large doses has a well-deserved

reputation as a drug for internal administration in doses of 40 minims three times a day, combined with sufficient aperient saline to neutralize its constipating action. Otherwise the treatment is symptomatic.

3. *Specific.* This consists in the hypodermic administration of antistreptococcic serum, ten or more cubic centimetres being injected daily, or every other day.

This method is specially indicated in cases with severe intoxication. The results vary, but there is sufficient evidence of its value to make its employment imperative in this type of case. In mild cases it is not necessary, and as the injection of the serum of another animal is often followed by joint pains and other discomforts, it should not be employed unless the severity of the symptoms demands it.

CHAPTER VI

ACUTE INFECTION OF THE LYMPHATIC GLANDS

THAT the lymphocytes do play a part, and a very large part, in the complex series of processes comprised under the term immunity, is fairly certain, but it is by no means easy to assign their precise rôle to these cells. As regards their function as tissue builders, lymphocytes are probably to be regarded as immature cells, possessing potentialities which enable them to undergo changes into connective tissue cells. An argument from structure to function is always dangerous, but it is difficult to resist seeing an analogy with the spermatozoon—a cell in which the same relationship between nucleus and cell protoplasm obtains. This similarity is highly suggestive of formative powers in reserve, rather than of actual activity. It is probable, however, that in resisting the inroads of micro-organisms, the lymphocytes play a part other than that of producing cells for the reconstruction of tissue which has been destroyed. The fact that they are non-phagocytic cells would seem to indicate that their function is to

play some part in elaborating the chemical substances which neutralize bacterial toxins, rather than in actually attacking and disintegrating the bacteria.

It is, however, sufficient for practical purposes to realize that structures such as the lymphatic glands, which consist essentially of lymphocytes, play a very large part in resisting disease, and it is this fact which explains the frequency with which the lymphatic glands are found enlarged in infective disorders. It is probable that enlargement of lymphatic glands may be considered as an evidence of their activity in resisting some toxic process, a point of some importance from a practical point of view. Enlarged lymphatic glands are to be looked upon as evidence of a resistance to a disease, rather than as a disease itself, and hence in many cases of enlargement excision of the affected glands is not only unnecessary, but actually involves the removal of an efficient protecting mechanism. It is only in diseases such as tuberculosis, where the organisms become almost completely confined to one set of lymphatic glands, and where the glands are no longer competent for the task which has been set them, that excision is advisable. In the case of more acute infections the treatment of enlarged glands is the treatment of the exciting cause, usually, that is to say, of the point of entry of the infection: the glands require to be aided in their work by removing any source of

pressure or irritation of the glands themselves, and by promoting a free blood-supply by fomentations, or other similar applications. When pus forms the abcess cavity is opened, any necrosed fragments removed, and the gland once more given a chance of overcoming the infection.

Acute adenitis is practically always due to an infection from some wound in the area from which the gland draws its supply of lymph; the size of the wound bearing no relationship to the degree of glandular enlargement. It is nearly always possible to find a definite wound or ulceration in the skin or mucous membrane, to account for the enlargement of the glands; but there are a few cases in which the glandular enlargement seems to come on without any actual cutaneous lesion, and in these the infective material probably enters the lymphatic system through the hair follicles. There are also cases of acute adenitis in general disease, but these are dealt with in another section.

Glands which are the seat of acute inflammation are enlarged, tender, and painful; the temperature is occasionally raised, and constitutional symptoms of septic absorption fairly well developed. The pain and tenderness of the gland leads to an immobilization of the part by the patient, who endeavours, often subconsciously, to keep the muscles round the inflamed area from pressing on the tender spot. Thus, with

acute adenitis in the triangles of the neck, it is common to find that the patient's head is held in a position which simulates torticollis, but it is usually more a deflection of the head to one side, than the twist which obtains in other varieties of torticollis associated with cicatricial contraction of the sterno-mastoid. In the axilla any movement of the arm is exceedingly painful, and the patient will keep the arm slightly away from the body so as to prevent pressure upon the affected glands. Similarly in an enlargement of the inguinal glands, the patient keeps the affected leg flexed, so as to relax tension upon the glands. To compensate for the flexion of the leg the toe is pointed, and the patient's gait is somewhat similar to that found in cases of hip-disease.

A microscopical examination of glands at this stage reveals very little structural alteration, except that among the lymphocytes, which compose so large a proportion of the glandular tissue, a number of polymorphonuclear leucocytes occur, often collected together in little clumps, throughout the gland. As the infective process progresses, the glands become larger, the inflammation spreading into the tissues around the gland, so that the glands become adherent to one another and to the surrounding structures. As a result of the effusion into the tissue between and around the glands a large, hard, diffuse swelling is formed, adherent not only to the skin but also to

the deeper structures, and presenting a picture very similar to that seen in some types of rapidly growing malignant disease. It is only rarely, however, that the diagnosis between these two conditions is difficult, the accompanying symptoms, the age of the patient, and the history of the case usually sufficing to clear up the diagnosis. Many cases, however, do occur in which the mistake is made, and a sarcoma has on many occasions been incised under the impression that it was an acute abscess.

If the glands at this stage be microscopically examined, small abscess cavities will be found scattered throughout the gland in various stages of formation; in some of them there is a definite point of pus, while in others there is simply a more marked collection of polynuclear leucocytes than in the stage previously examined.

The fact that this acute inflammatory process is going on at a very large number of points, often scattered throughout the whole group of glands, is very important from the point of view of treatment, as it is obvious that no incision can be made which will reach the whole of these microscopic abscesses. In cases in which a definite abscess cavity can be diagnosed it must, of course, be incised, but when definite fluctuation cannot be obtained, it is wiser to be guided by the constitutional symptoms rather than by the local physical signs, and, when the

constitutional disturbance and pain are not severe, to postpone operation. The treatment of such a case will consist in first removing any source of irritation; any sore or septic focus should be dressed, and if the infection is suspected to originate from the mouth, an attempt should be made to procure a healthy condition of the mucous membrane by the use of an antiseptic mouth wash or paint,[1] and by efficient treatment of any carious teeth. If the infection originates in the tonsils or in adenoid growths of the naso-pharynx, it is not advisable to resort to any operative interference with these structures, inasmuch as the operation must of necessity leave an infected surface from which organisms will continue to gain access to the gland. The local pain and tenderness will be best relieved by hot fomentations frequently applied; and, in addition, a brisk calomel purge should be given. It is sometimes maintained that fomentation accelerates suppuration; that is to say, that a case which otherwise would not have suppurated, does so when they are applied. There seems, however, to be no definite evidence of this; and the number of cases which resolve under such treatment without suppuration, when this seemed inevitable,

[1] A good formula for this purpose is—
℞ Resorcin ʒss
Potass. Chlorat. gr. x
Glycerini Boracis ad ℥j

points to the fear of inducing suppuration by fomentation being entirely groundless. The fact that a fomentation produces an increase in the number of leucocytes in a given part has lent some colour to this form of error, but it must be remembered that the advent of the white blood corpuscles to an infected spot is a sign of resistance to the infection on the part of the body, and not a sign of disease. It is just this local leucocytosis which in many cases determines the resolution of the swelling.

If these methods of treatment prove unsuccessful, the glands will continue to enlarge, and ultimately a soft spot will appear in the centre, indicating the presence of a definite abscess cavity. The pus makes its way towards the skin, which becomes red and oedematous, ultimately giving way, and affording an outlet for the pus. When there is no doubt as to the formation of a definite abscess, there is no longer any need for delay, and an incision should be made into the abscess cavity. It is not usually necessary to make an extensive incision, one of a half to three-quarters of an inch in length being usually ample, provided that the operation is performed under rigid aseptic conditions. The incision should be made in a direction parallel to the line of cleavage of the skin, so as to leave the minimum amount of scarring. In the neck, which is the situation where scars are most objectionable, the line of cleavage runs almost

directly around the neck, so that the incision will be almost transverse, inclining towards the sternal notch at its anterior extremity. This line of incision is not in accord with the rule so commonly given, that abscesses should be opened by incisions parallel to the great vessels and nerves which are in the neighbourhood. But in the neck, in the majority of cases, the abscesses are entirely superficial to these structures, and it is very unlikely that any wound of the carotid artery or jugular vein will be inflicted; in other parts of the body a scar is of no importance, and the incision may be made parallel to the great vessels. If the abscess cavity is close up to the skin it will be opened at once by the incision; but if it is beneath the deep fascia, the classical method of Hilton should be adopted. After the incision has been made through the skin, a pair of blunt-pointed forceps is taken and the abscess penetrated by a process of blunt dissection, thus obviating any risk of injury to important structures. As soon as pus is reached the blades of the forceps are forcibly separated, the opening enlarged until it is as extensive as the skin wound, the pus evacuated, and a drainage tube stitched in position.

Before applying the dressings it is a good plan to put a stitch at each extremity of the wound, horsehair or silkworm gut being the best material to employ for this purpose. With an incised wound which is not

completely sutured the drainage tube or packing tends to exert a tearing action upon the extremities of the wound, and if this were excessive the wound would actually be enlarged in both directions. Under ordinary circumstances this, of course, does not occur, but the stretching tendency is always present, and is one of the reasons why packing a wound is often an extremely painful procedure. The presence of a stitch, however, avoids this, the tension being exerted upon the suture material and not upon the partially divided nerves in the angles of the wound.

It is impossible to lay too much stress upon the need for rigid antiseptic precautions in these operations. An incision made, without previous purification of the skin, into an abscess cavity which is then dressed with a poultice, or even with a fomentation, is often followed by a very profuse discharge of pus; but this does not so much mean that the drainage is pre-eminently satisfactory as that the suppurative process is continuing.

The exact method by means of which incision and drainage of an abscess cavity bring about healing is by no means certain; but it must be remembered, that suppuration indicates that there has been a conflict between the tissues of the body and an invading organism. While the necrosis of the tissue cells is a sign that the organism has temporarily gained the upper hand, the latter has none the less been subjected

to the resistance which the natural fluids of the body provide, and has in consequence been diminished in vitality and virulence. The extent to which this has occurred can be well seen by contrasting the clinical course of a case of suppuration in the inguinal glands following a septic wound of the leg, with one of bubonic plague, a disease in which the resistance of the body seems to be almost entirely futile. On the one hand, a localized abscess forms with comparatively trivial symptoms, healing readily as soon as the pus has been evacuated; on the other, we have an infection with profound septicaemia and with acute necrosis of the gland and the surrounding tissues. After pus has been once evacuated, the abscess cavity becomes flooded with blood plasma containing the natural infection-resisting substances, and will heal readily. Indeed, after an abscess has completely formed with a definite abscess wall, it is common to find that the discharge after the first twenty-four hours is entirely serous, the suppurative process being entirely arrested, and the wound healing almost as quickly as an aseptic incision; whereas, if unsterilized instruments or dressings be employed, the partially devitalized organisms are reinforced by fresh and vigorous ones, leading to a serious prolongation of the struggle between parasite and host and retarding greatly the healing of the wound.

If there is much haemorrhage from the wound or

from the abscess cavity, it is a good plan to pack it firmly with double cyanide gauze. This is removed after twenty-four hours and replaced by a drainage tube, which should be provided with a safety-pin or a long thread of silk, to prevent it slipping into the cavity.

It seems strange that a foreign body such as a drainage tube can be introduced into an acute abscess and remain in position beneath the skin after the abscess has completely healed, but this sometimes occurs. For example, a patient had had an axillary abscess opened, which was drained by a short length of india-rubber tubing about a quarter of an inch in diameter. Some months later, long after the abscess cavity had healed, he applied for advice concerning an elongated swelling in the axilla, which was rather painful and which he believed contained the drainage tube. An incision was made into the swelling and the tube removed.

Drainage of an abscess cavity by means of a wick of gauze is never entirely satisfactory. A piece of gauze will absorb a certain amount of pus, and for this amount it is an efficient drain; but as soon as it becomes saturated it serves simply as a plug which dams up the pus behind it, and is for this reason very inferior to a drainage tube. The best dressing for an acute glandular abscess is a large mass of double cyanide gauze sterilized in an autoclave, or, where this is not

available, wrung out of a 1 in 4,000 solution of perchloride of mercury. If it be desired to combine with an aseptic dressing the advantage of a fomentation or poultice, this may be done by boiling the gauze in the mercurial solution, and wringing it out before it is applied. The gauze is then covered with a mass of sterilized or salicylic wool, and a bandage applied.

After incising a glandular abscess the pain usually diminishes almost immediately, and if the aseptic precautions are rigidly carried out, it is not uncommon to find, especially in young children, that an abscess which contains about an ounce of pus is completely healed within ten days.

There is a group of cases of acute adenitis which are very difficult to deal with. In these the infecting and resisting processes are very equally balanced, so that while the inflammation is maintained or slightly increases, there is no formation of an abscess cavity. Pain and tenderness, however, persist; and, although a careful search is made each day for indications of suppuration, none are found. The swelling may persist for many weeks without resolution, until, under the impression that there must be a deep abscess at some point which it has not been possible to detect, the surgeon makes an incision over the swelling, and forces a pair of sinus forceps in all directions, in the hope of finding such a cavity. No pus is, however, found, a little blood and serous fluid alone escaping.

In these cases, a drainage tube should be inserted, and the wound dressed. Although at the operation no pus has been evacuated, the glands in some cases immediately begin to diminish, and a complete recovery is obtained. In others, the wound takes on a dirty sloughing appearance, and only heals completely after several weeks. In acute adenitis, curettage of the abscess cavity is practically never required: to scrape out an abscess cavity is to destroy the line of defending cells, and often leads to a spread of the infective process.

When, however, there is a necrosis of the gland with the formation of extensive sloughs, scraping of the abscess cavity or even excision of the whole affected mass is necessary. Such a condition exists in the acute enlargement of the inguinal glands which follows a soft chancre. In these the sloughing is often tedious, definite well-formed abscesses do not occur, and recovery is distinctly hastened by a complete excision of the whole glandular area. There is another type of case in which the same treatment is necessary. A surgeon in resecting a rib for drainage of an empyema scratched his finger with a projecting fragment of bone. As a result, a large mass of glands containing small abscess cavities appeared in the corresponding axilla, and it was only after a thorough excision of these affected glands that satisfactory recovery could be obtained. There is, of course, a risk in all such

cases that excision of the affected glands may light up an acute infection of the surrounding cellular tissue; but this is by no means the usual result, the wound generally healing quite readily, provided that satisfactory drainage is maintained.

CHAPTER VII

RETRO-PHARYNGEAL ABSCESS

While the general tendency of suppurating glands in the neck is to form abscesses which point on the surface of the body, infection of certain deep glands situated in the neighbourhood of the pharynx gives rise to an abscess which burrows backwards behind this organ, pushing forward its posterior wall, and obstructing breathing and swallowing. The clinical appearances of such acute retro-pharyngeal abscesses is usually quite typical. The other glands in the neck are generally enlarged also, but the amount of this varies; it is usually quite well marked, but in some cases the degree of swelling on the side of the neck is out of all proportion to the size of the deep abscess.

These cases occur most commonly in children, and cause very considerable distress to the patient. Swallowing is difficult and painful, breathing is noisy, and has a peculiar choking, guttural sound, very different from the crowing inspiration which accompanies laryngeal obstruction. There is often an excessive secretion of mucus, which tends to exaggerate the distress. If a finger be passed to the back of the throat the obstruction can be readily felt, protruding into the pharynx,

just behind the tonsil. It is rarely accurately in the middle line, being usually situated to one side or the other.

These cases call for the promptest treatment, as not only is the mechanical obstruction produced by the abscess to be feared, but there is always the risk that the abscess may burst, and the pus be sucked into the lungs. The infection may also spread to the lymphatics around the opening of the glottis, giving rise to acute oedema glottidis and death from asphyxia.

For the reasons given above, these abscesses should be opened with all due antiseptic precautions, and for this reason, if for no other, opening and draining these abscesses through the mouth is a mode of treatment which should be condemned. It must be admitted that many cases have recovered perfectly well, after drainage into the mouth, but apart from the continual re-infection of the abscess cavity, the possibility of error in diagnosis must always be borne in mind. In some cases the enlargement of other glands in the neck is not very pronounced, and the origin of the retro-pharyngeal abscess from a suppurating gland, or from suppuration around the gland, is by no means certain. Retro-pharyngeal abscesses are also derived from caries of the cervical spine, and a pharyngeal incision in such cases is obviously disastrous, whereas drainage of such an abscess cavity at the side of the neck is perfectly good treatment. Under the best

circumstances, a pharyngeal incision must entail the whole of the discharge from the abscess being swallowed, a condition of affairs which should be avoided wherever possible. The only advantage which the pharyngeal method affords is the absence of a superficial scar, but this is a point which should not be allowed to have any weight in the treatment of cases of such gravity. The best method of opening these abscesses is by an incision of the posterior border of the sterno-mastoid muscle. This may be made slightly obliquely, so as to minimize the resulting scar, without any detriment to the subsequent operation. It is in cases of this kind that the value of wearing india-rubber gloves is specially seen, enabling the naked finger to be inserted into the mouth during the first stage of the operation and allowing a glove to be put on for the final treatment of the wound.

As soon as the skin has been divided the fore-finger of one hand is inserted into the mouth, which is gagged widely open: the surgeon then takes a pair of sinus forceps in the other hand, and by a process of blunt dissection works his way behind the carotid sheath towards the abscess cavity, the position of which is determined by the finger in the mouth. The forceps are passed on until pus is reached, and the blades entering the abscess can be felt by the finger within the mouth; the blades are now separated and the pus allowed to run out. Before removing the finger from

the mouth the pharynx should be thoroughly explored so as to make certain that every pocket of pus has been reached, as it sometimes happens that these retro-pharyngeal abscesses are multilocular. With the forceps still in position, a rubber drainage tube is inserted along the side of them, and its position in relation to the pharynx carefully ascertained, the opening of the tube being arranged just within the abscess cavity. The hand which has been within the mouth is then rinsed in an antiseptic solution, and guarded by an india-rubber glove which has been previously sterilized. The drainage tube is secured by a couple of silkworm-gut sutures and the angles of the wound sutured. The subsequent course of these cases usually presents no difficulties, the swelling of the pharynx disappearing rapidly, and the patient becoming once more able to breathe and to swallow without difficulty. Complications, however, do occur. It must be remembered that there is a drainage tube in close proximity to the pharyngeal veins, and also to the internal jugular; and in one case the suppurative process and the pressure of the tube combined to cause ulceration of a large vein which produced fatal haemorrhage. Haemorrhage of this type is, however, rare, but owing to the congestion produced by the pressure of the abscess and by the inflammatory process there may be fairly smart venous haemorrhage during the operation.

In one case a patient was admitted to the Hospital

with the ordinary symptoms of retro-pharyngeal abscess, and an attempt made by the resident medical officer to open the abscess by the method already described. On attempting to pass the forceps towards the abscess cavity, such furious haemorrhage was met with that he deemed it advisable to pack the wound and to abandon the operation for the time being. A second attempt was made to reach the abscess in the same way, but with the same result: careful examination, however, showed that the projection into the pharynx was lower down than usual, and that it would be impossible to reach it, without displacing a large mass of lymphatic glands. Accordingly the haemorrhage was arrested by firm packing and a free incision carried downwards along the posterior border of the sterno-mastoid muscle. A large mass of glands was then excised, after the usual long and tedious dissection, and it was only when this had been done that the wall of the retro-pharyngeal abscess was brought into view. The abscess was then opened and drained in the ordinary fashion. The packing was next removed, when it was found that the haemorrhage had almost completely ceased, owing probably to the relief of venous congestion produced by removal of the glands and emptying the abscess cavity. One or two ligatures were applied, and complete haemostasis obtained. The patient made an excellent recovery, and was seen several years after the operation quite well and strong.

CHAPTER VIII

GLANDULAR FEVER: NON-VENEREAL BUBO: STILL'S DISEASE

GLANDULAR FEVER

A class of case has been described by Peiffer to which he has given the name of *Glandular Fever*, but the acceptance of this as a pathological entity is by no means assured. He describes an infective disease of children under fourteen, in which there is a sudden onset with a rise of temperature ranging from 101° to 103°, loss of appetite, nausea and occasional vomiting, headache, constipation, and all the symptoms of septic absorption. The muscles of the neck are stiff and painful, and the pharynx may be slightly injected, but there is no definite pharyngitis, and no affection of the tonsils. After two or three days, the glands in the anterior triangle become swollen and tender, usually upon the left side, and the abdomen becomes tender and painful, probably from a similar affection of the mesenteric glands. The other glands of the body may be enlarged and tender, but not as commonly or as constantly as the glands in the carotid triangle. The

temperature oscillates for a week or ten days before becoming normal, falling usually by lysis. The liver and spleen are occasionally enlarged also. The condition is usually trivial, the patient making a good recovery as soon as the temperature has fallen; but in some cases there is a considerable amount of anaemia, which requires some time for its disappearance.

Epidemics of this condition occur, the best marked of which is the one reported by West, in Ohio, where ninety-six cases were observed. Much doubt has been cast upon the specific nature of the affection, and the view adopted by Comby, that it is an attenuated streptococcal infection through the tonsil, is probably accurate. It is quite common to find young children, especially those who live in the crowded streets of great cities, with masses of enlarged glands but no very definite pharyngeal affection. It is quite possible, however, that streptococci may affect the glands in the anterior triangle by passing through the pharyngeal lymphatics, without setting up any local lesion at their point of entry, a mode of infection which is definitely known to occur in tuberculosis. It is probable, therefore, that glandular fever should be considered as a type of acute glandular infection via the pharynx, rather than as a separate and definite disease. The treatment of this condition is on symptomatic lines similar to those laid down for other cases of acute adenitis. If abscesses form they must be opened in

the usual way; but this seems to be a very rare occurrence.

NON-VENEREAL BUBO

Enlargement of the inguinal lymphatic glands without any very obvious cause has been described by writers upon military and naval surgery, under the name of *Non-venereal Bubo*. In the majority of these cases, however, there is a history of strain, or of a trivial wound, and, as has already been noted, the relationship between the amount of glandular infection and the size of the wound through which the infection has come may vary considerably. A patient may have a large suppurating cavity, with little or no glandular enlargement; but on the other hand, a small cut, which heals without difficulty, may give rise to troublesome abscesses in the corresponding lymphatic gland; the determining factor being the virulence of the organism which has been introduced. It is often found that the inguinal glands become enlarged in athletes after violent exercise, and it has been assumed, with reasonable probability, that in these cases the organisms have worked through the skin, along the hair follicles; the constant friction of the clothes, or of one part of the body upon the other, being quite sufficient to explain this phenomenon. It is probable, therefore, that these cases are strictly analogous to glandular fever, and present no features which justify their separation as

a distinct disease. This theory is further borne out by the fact that the glandular enlargement is entirely confined to the inguinal region.

STILL'S DISEASE

A type of rheumatoid arthritis has been described in children by Still, commencing before the second dentition and associated with enlarged glands. The joint affection presents a chronic uniform thickening of the tissues around the joint cavity, and very little alteration in the synovial membrane or in the bones. The disease comes on insidiously and progresses steadily, spreading from joint to joint, until the child may be practically bed-ridden, with its joints fixed in a position of semi-flexion. There are many differences, therefore, from ordinary rheumatoid arthritis, a condition which occurs moreover in children, presenting the same characteristics as the adult type of disease.

The glands in immediate relationship to the joints are enlarged to the size of a hazel nut; they are hard, discrete, and painless; they do not suppurate, and do not become adherent to the surrounding structures. If the joint condition improves, the glands also diminish. An organism has been described in rheumatic joints which usually occurs as a diplococcus, and Horder and Andrews have identified this with the Streptococcus faecalis, which is a common inhabitant of the alimentary canal. It is probable, therefore,

that in many of these cases we have to deal with an infection of the joints from the alimentary canal, the organisms being conveyed by the blood stream and affecting the glands secondarily.

CHAPTER IX

LYMPHATIC ENLARGEMENT IN GENERAL DISEASE

An enlarged lymphatic gland associated with a sore in the region from which it derives its lymph affords an example of a local resistance to a local infection, the lymph gland preventing the passage of the organism into the general circulation, either completely or to a very great extent. There are many diseases, however, in which the infection is generalized from the commencement, the lymphatic glands all over the body becoming infected secondarily.

In syphilis, the connexion of which with the Spirochaeta pallida is now fairly well established, we have an infective disease which spreads very rapidly throughout the body, producing not only a local lesion at the point of entry of the organism, but widespread and equally typical lesion all over the body. Here the lymphatic glands are usually affected, and their enlargement affords a very valuable diagnostic feature in the disease; not only are the glands nearest to the primary source affected, but glands such as those at the upper part of the posterior triangle of the neck and the supra-

condylar gland are equally affected. These glands are discrete, round, hard, and painless; their presence, although valuable as a diagnostic point, is unimportant; they never suppurate, and indeed the patient is usually unaware of any change in them. The treatment of such glands is the constitutional treatment of syphilis; and with the disappearance of the secondary symptoms enlargement of the glands disappears.

Another excellent example of the enlargement of glands in constitutional disease is afforded by bubonic plague. In this disease we again have infection by a definite organism, the Bacillus pestis, which can obtain an entry into the body in a very large number of ways. It may be introduced through the mucous membrane of the alimentary canal, or respiratory tract; it may be introduced through a wound in the skin, through a small abrasion or crack, or even by the bite of an infected insect. The typical course of the disease consists primarily of an intense septicaemia, with all the symptoms of collapse, delirium, restlessness and fever, which occur in other acute septic infections. Quite early in the course of the disease enlargement of the lymphatic glands occurs, most commonly of those in the groin; but also with moderate frequency in the axillary and cervical groups. The incidence of plague upon the inguinal glands is peculiar, demonstrating as it does a difference in vulnerability between the various groups of lymphatic glands. An attempt

has been made to explain this phenomenon by assuming that the common site of the primary infection is the foot; but although it is true that this disease occurs most commonly among races that habitually do not wear boots, and in which the feet are exposed to injuries and the bites of parasites, there is evidence that this is not the true explanation. A pathologist, while performing a post-mortem examination on a case of plague, accidentally scratched the front of his left fore-arm with an infected knife; in spite of vigorous attempts to disinfect the wound, he was seized, after forty hours, with sudden pain in his left groin combined with all the constitutional symptoms of plague, and in another eight hours a typical femoral bubo developed.

It would seem, therefore, that in plague we have a general infection of the whole body by the Bacillus pestis, in the attempt to overcome which, the lymphatic glands are intensely affected, the brunt falling most heavily upon those in the inguinal region. It is interesting to note also that, in addition to the general infective process, there is a more localized affection spreading from gland to gland, producing the so-called secondary buboes. The severity of the inflammatory process in these secondary buboes is, however, much less marked than that in the primary gland.

There is perhaps no glandular affection so intense as that which occurs in plague. Within a few hours the infected gland is teeming with bacilli, as a result of

which enlargement of the gland and acute infiltration of the surrounding cellular tissue occurs. The cells seem to offer but little resistance to the infection, or at any rate the resistance they offer is comparatively futile. There is but little phagocytosis, the cells necrosing very rapidly, and converting the gland into a diffluent, sloughing, almost structureless mass. The necrosis is not limited to the gland, extending through the capsule into the surrounding tissue, so that when the patient survives long enough for the skin to be destroyed extensive sloughing ulcers are formed. The Bacillus pestis seems to have also a particularly destructive action upon blood-vessels, so that quite early in the development of the bubo the blood-vessels give way, and extensive haemorrhage occurs into its substance. The large veins in the neighbourhood are frequently eroded, so that the contents of the bubo escape directly into the blood stream and are carried to all parts of the body.

CHAPTER X

TUBERCULOUS LYMPHATIC GLANDS

Of all causes of chronic enlargement of lymphatic glands tuberculosis is by far the most common. The disease occurs most frequently in children between the age of two years and puberty; in older patients it is by no means uncommon, but rarely starts after middle age.

An attempt has often been made to describe a type of patient who is specially liable to this disease. But although most of the patients are poorly nourished and in bad general health, it must be confessed that many of them are quite normal, apart from the glandular enlargement. Cases are met with of patients who have suffered from extensive glandular tuberculosis in spite of a free open-air life and great bodily vigour. Among the poor who live in the crowded streets of large cities, chronic glandular enlargement is extremely common, and although many are not actually tuberculous, the chronic adenitis certainly predisposes to the condition. Children who are the subject of pulmonary tuberculosis very frequently exhibit glandular enlargements

as well; but the converse is by no means true, as tuberculosis commencing in the lymphatic system usually remains confined to it throughout the whole course of the case. The great exception to this rule is afforded by cases in which the posterior mediastinal glands are extensively affected; for in these cases the disease often spreads into the root of the lungs, or, invading the thoracic duct, gives rise to a general tuberculosis.

The tubercle bacillus frequently obtains an entry into the body by a very roundabout path; for example, in one child a mass of tuberculous glands was discovered in the axilla, obviously secondary to a subcutaneous nodule in the hand. In this case the original infection probably took place through the mucous membrane of the alimentary canal, the bacilli entering the general circulation and becoming deposited in the subcutaneous tissue; in this situation they increased in number and ultimately infected the corresponding lymphatic gland.

It would seem that the tubercle bacillus is quite capable of passing through an epithelium-covered surface, without giving rise to any local lesion, so that cases of extensive tuberculosis of the peritoneum and mesenteric lymphatic glands are very commonly found, without the very slightest affection of the intestinal mucous membrane. In the lungs of children it is also the rule to find, that the bacilli pass through

the endothelium of the pulmonary alveoli, and only give rise to the characteristic lesions of tuberculosis when they reach the glands at the root of the lung; although extensive pulmonary disease may be produced secondarily, by spread of the disease from the root into the substance of the lung.

This theory, that mucous membranes allow bacteria to pass through without producing any lesion at the point of entry, has been denied, but there is an overwhelming mass of clinical and pathological evidence in support of it.

Although it is always hazardous to argue *a priori* about the defensive action of the body against bacteria, it is pretty certain that the passage of bacteria through mucous membrane must be taking place continually. If this did not occur, the whole task of resisting infection would rest with the epithelial and other superficial cells; and, inasmuch as a complicated mechanism for this purpose can be demonstrated in the cells and fluids of the rest of the body, it is only reasonable to assume that the bacteria are handed over to them for destruction, the epithelial cell possessing the power of protecting itself.

The most common situation in which tuberculous glands are found is in the side of the neck, at the upper part of the anterior triangle. The cause of this is probably to be found in the fact that these glands receive their lymph from the tonsil and from

the naso-pharynx, a region which in children is so frequently the seat of adenoid growths. Tuberculosis of the tonsil and of adenoid vegetations is not particularly common; although more recent investigations have shown that it is not as rare as was at one time supposed. The bacilli in this region pass through the lymphoid tissue of the tonsil and of the adenoids, and only give rise to definite tuberculosis when the cervical lymphatic glands are reached.

It is difficult to trace the exact stages by means of which the advent of a tubercle bacillus into a lymphatic gland gives rise to the characteristic tubercle, especially in a structure where the cells are so closely packed together as in a lymphatic gland; but from observations on other organs the course of events is probably as follows: the bacilli, on reaching the gland, commence to multiply, and in the process of their growth, the products of their metabolism set up a localized irritation, which calls forth a corresponding reaction on the part of their host. This is at first evidenced by the appearance of a number of polymorphonuclear leucocytes, a type of cell which seems to play a very secondary part in the later stages of the disease. The small round cell, however, soon acquires a prominence in the microscopic picture of the developing tubercle; a prominence which it maintains throughout. The origin of these small round cells, which it is difficult to differentiate from

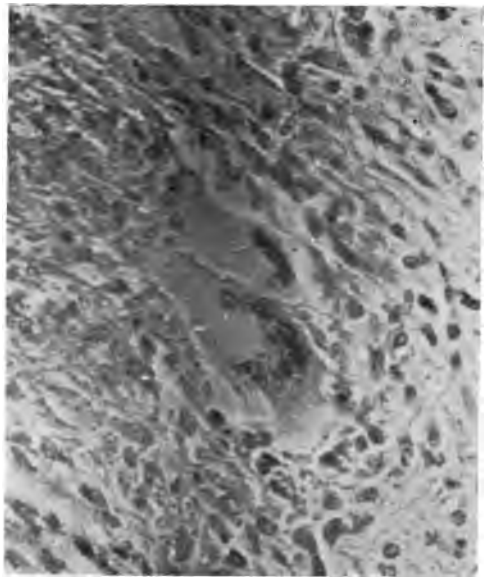

Fig. 6. Giant cells from a tuberculous lymphatic gland.

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the lymphocytes of the blood and the lymphatic glands, is at present not perfectly clear; but it is extremely probable that they are actually derived not only from these sources but also from the connective tissue cells in the neighbourhood.

Their relationship also to the next cell, which is so characteristic of tuberculosis, namely the giant cell, is also difficult to determine exactly; but it is probable that the small round cell in its attempts to overcome the infecting organisms assumes a more active rôle. Its protoplasm increases in amount, and its nucleus takes on the vesicular appearance which is so characteristic of growing cells. The result of this change is to produce a large number of epithelium-like cells which occupy the centre of the tubercle, and are termed epithelioid cells. Within this mass of epithelioid cells there occur a number of very characteristic giant cells, which are very probably produced by the imperfect division of some of them. The portion of the cell which is turned towards the centre of the tubercle is exposed to the action of the bacterial toxin, and although the nuclei are able to multiply, the cell protoplasm, being more or less poisoned by the toxin, cannot follow suit, remaining, therefore, undivided; and the nuclei, migrating to the opposite pole of the cell and there dividing, give rise to the appearance of a horseshoe-shaped ring of nuclei, arranged around the periphery

of that portion of the cell which is farthest away from the centre of the tubercle.

Whatever may be the exact history of the origin of the tubercle, it is certain, however, that the tubercle bacillus ultimately produces a series of small greyish nodules, or tubercles, which are scattered throughout the organ affected. These are about the size of a millet seed, and consist of a layer of round cells surrounding a larger layer of epithelioid, which in its turn encloses a central core of one or more giant cells. The whole of the tubercle is avascular. Quite early in its life-history a network of homogeneous material allied to, but probably not identical with fibrin, is laid down in the interstices of the tubercles; and in the later stages this has become a mass of yellowish material, resembling tough wash-leather in its consistency.

The tubercles do not long remain isolated, but very early begin to run together and produce large masses of tuberculous tissue, in the centre of which, the homogeneous material above referred to is found in sufficient quantity to be easily apparent to the naked eye. As the disease extends, this material comes to earn its name of 'caseous material' more thoroughly: from being tough and leathery, it becomes soft and cheesy, and ultimately diffluent resembling pus. Microscopically, however, it has many points of difference from the pus which is found in an acute

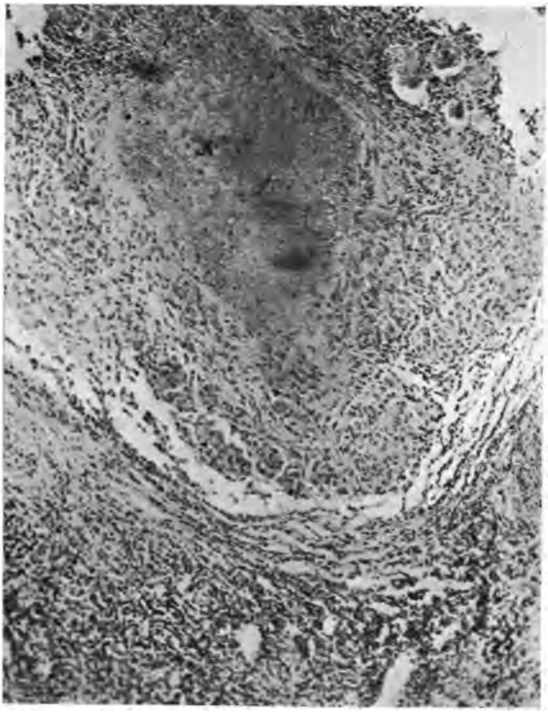

Fig. 7. Caseating tubercle from a cervical gland.

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abscess. It contains very few cells, and these are almost all lymphocytes. The liquor puris contains a number of fatty granules, but is otherwise structureless; and it is only in those cases in which the invasion of pyogenic cocci, in addition to the tuberculous bacilli, has given rise to a mixed infection, that there is any difficulty in distinguishing between the pus in a tuberculous and an acute abscess. The pus in a tuberculous abscess contains tubercle bacilli, but it is often impossible to demonstrate their presence by histological methods. If it be desired to confirm the clinical and anatomical diagnosis, it is often necessary, therefore, to resort to inoculation experiments.

The glands themselves, in the early stages of the disease, do not as a rule show much enlargement; and it is not common to find lymphatic glands larger than a hazel-nut in which the process of caseation has not already made great strides; but cases do occur, in which glands are found as large as walnuts in which there is no sign of caseation. It is important to bear this fact in mind, because the surgeon is tempted, unless a microscopic examination be made, to regard these as lymphadenomatous glands. A microscopical examination, however, very rarely leaves any doubt about the diagnosis.

Although the progress of the enlargement of glands is, up to the point of caseation, often very slow, the subsequent stages are usually extremely rapid; and

as soon as a gland has become softened from the breaking down of the caseous material within it, the increase in size takes place with enormous rapidity, so that in a comparatively few days a large abscess appears.

In addition to the development of the tubercle within the glands, an increase in the connecting tissue framework around the glands takes place, as a result of which, the glands become very rapidly matted together, and in the later stages adherent also to the surrounding tissues. As a result of the confluence of the previously isolated glands, and the increase in the caseation within them, the caseous material of neighbouring glands unites, so that abscess cavities are formed which are not confined to one gland, but ramify throughout the whole mass. This is a point of extreme practical importance, as it leads to the formation of abscesses, part of which may be quite superficial, while part may lie much deeper. Thus, in the anterior triangle of the neck it is common to find an abscess pointing over the anterior border of the sterno-mastoid muscle. It would be easy to open this abscess, and remove the whole of its contents and its wall, by means of a sharp spoon, but it is found that this mode of treatment very frequently fails; the explanation being that the deeper part of the abscess, beneath the deep fascia, has not been reached, and the cavity

produced by the operation has been rapidly reinfected from the underlying abscess. It is for this reason that a radical extirpation of the glands is the only method which affords any certainty of curing the disease.

TREATMENT

A common type of case which presents itself for treatment is that of the patient in whom a few enlarged glands have been noticed at the anterior border of the sterno-mastoid. These glands have been definitely enlarged for about a couple of months, and have increased very slowly in size. The patient's general health has been but little affected, and no definite symptoms beyond slight anaemia have been produced. In such cases, the first point to be considered is the source whence the infection has come. A rigorous examination of the teeth, tonsils, and naso-pharynx should be made, any carious teeth removed or filled, and enlarged tonsils or adenoid vegetations removed. It is quite useless to attempt surgical treatment of such glandular enlargements, while the source of infection remains. Tuberculosis of a lymphatic gland very commonly follows upon chronic inflammation, and it is extremely difficult in actual practice to discover the exact point at which the tubercle bacillus gains a foothold. It will often happen that removal of all the sources of irritation will lead to a very great improvement in the

enlargement of the glands, or even to their complete disappearance. In the event of the persistence of the swelling, the question has to be considered as to whether operative interference should be instituted at once or palliative measures tried.

As regards the cure of the disease, there is no form of treatment whose efficacy at all approaches that of a radical extirpation. But in early and slight cases there is always the disquieting feeling in the mind of the surgeon that he may have been led to operate upon a case in which the glands would have subsided spontaneously. Many of these patients have small glands in other situations—in other parts of the neck, in the axillae and groins—and in such cases it is often inadvisable to submit the patient to an operation when only a small portion of the disease can be removed. For example, it is not good practice to excise a small mass of glands on one side of the neck when the patient has glands on the other side of the neck, in both axillae, and in both groins. In such a case there is probably infection of the mesenteric and mediastinal glands also; the removal of so small an amount of the infection hardly compensating for the strain of the operation. When, however, the glandular enlargement is confined to the neck, the issue is simpler, and it may be stated that in these cases, whenever the diagnosis of tuberculous infection, apart from chronic inflammation, can be made, an

operation should be performed. The objections to an operation of this kind are not very great, that which bulks most largely in the mind of the patient being the formation of a permanent scar. Indeed, if scars could be entirely avoided there is probably no mode of treatment less painful and less trying to the patient than an operation. It must be borne in mind that the finest cosmetic results are obtained in cases where the operation is performed before the glands have broken down or become adherent to the skin. It is this latter point which, perhaps, determines, more than any other, the success of an operation from the cosmetic point of view, as it is almost hopeless to attempt to remove a wide area of skin and yet produce a fine linear scar.

The course of the disease can be divided into several stages, and the line of treatment to be pursued varies with the stage at which the case is first seen. In the case of a mass of enlarged glands such as has been considered, in which the evidence of tuberculosis is still equivocal, and in which removal of sources of irritation has produced no good results, it is well to attempt to improve the patient's general condition by hygienic measures.

The patient should be placed under the very best and healthiest surroundings. He should live, as far as possible, an out-of-door life, preferably by the sea. Exercise short of fatigue should be freely taken, and,

if the patient is a child, he can be allowed to play about without any restrictions. The clothing should be warm but light; that is to say, the error so commonly seen, of loading delicate children with an excessive number of garments 'to prevent them catching cold' should be avoided. The diet should be full and generous, including as much milk and cream as the patient can readily digest.

As regards drugs, the most valuable are cod-liver oil, preferably in the form of an emulsion, and syrup of the iodide of iron, given in doses of 20 minims to a drachm in a tablespoonful of water three times a day. This line of treatment, however, must only be followed with a child under strict observation, so that the moment may not be allowed to pass at which a satisfactory operation can be performed. If there is not a continuous and pronounced improvement no further time should be wasted, and an operation should be performed.

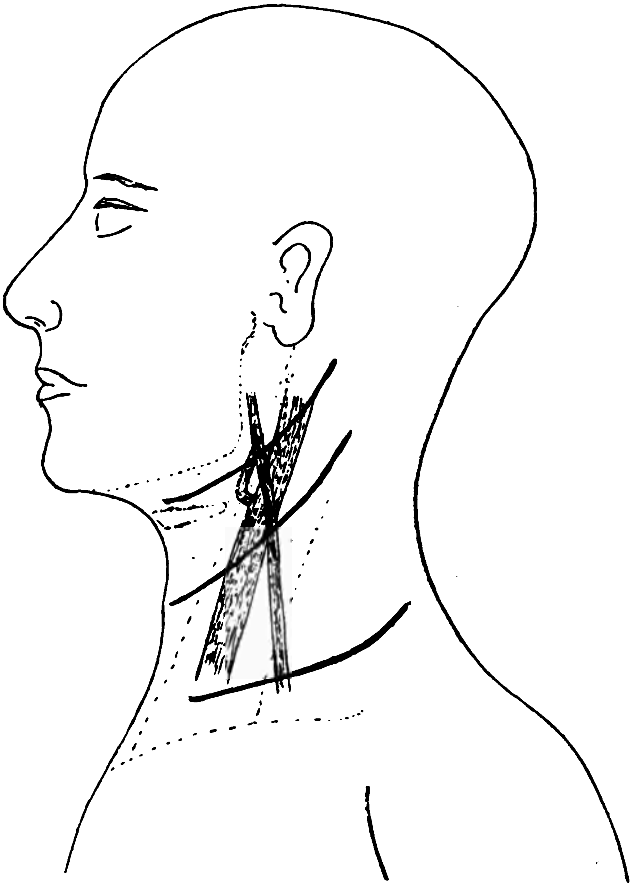

FIG. 8. Diagram showing the lines of incision recommended for removal of tuberculous glands in the neck. The outlines of the sterno-mastoid muscle, the hyoid bone, the lower jaw and clavicle are indicated by the dotted lines. The shaded structures represent the internal and external jugular veins and the communication between them.

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CHAPTER XI

THE OPERATIVE TREATMENT OF TUBERCULOUS GLANDS IN THE NECK

It will be convenient to consider first the operative procedure which should be undertaken in an uncomplicated case in which the glands affected are confined to the set along the great vessels of the neck and are still unattached to the skin, that is to say, in which complete removal is possible.

A large variety of incisions have been suggested for the removal of tuberculous glands, the best of which are shown in the diagram. The incision for any particular case will have to be planned according to the requirements of that individual case, but there are certain general principles which must be borne in mind. Incisions parallel to the borders of the sterno-mastoid muscle are very frequently employed, but are inferior to those made at an angle with them.

If the abdomen of a patient be examined after parturition, or after the removal of a large abdominal tumour, a number of lanceolate scar-like areas will be

noticed—the well-known 'lineae albicantes'. Although the tension has been uniform, these scar-like areas are distributed in distinct lines, their long axes running round the abdomen parallel to Poupart's ligament. This shows very clearly that the skin is not a uniform structure, but has definite lines of cleavage, which run around the body, roughly at right angles to its long axis. In the neck they correspond fairly well in direction to the folds of the skin which are produced when the neck is flexed. An incision made in the line of cleavage of the skin leaves a scar which is much less prominent than one made in any other direction. The scar, falling in the line of the fold of the neck, resembles a natural furrow, and this again makes the cosmetic results better.

For the removal of a mass of glands lying along the vessels an incision is made about 3–4 inches long, with its centre over the most prominent portion of the tumour passing forwards and slightly downwards across the neck. The first structure to be met with after the division of the skin and platysma is the external jugular vein, and it is as well to divide this between ligatures at once.

The next point is to define the fibres on the sterno-mastoid muscle, so as to get an indication of the depth to which the incision must be carried. Having exposed some part of the muscle, the fascial structures are turned forwards until its anterior border is reached.

The next stage of the operation is to expose the internal jugular vein; this lies immediately under the anterior border of the muscle, and is exposed by making a small incision in the deep fascia at the lower end of the wound. This opening is then enlarged with a blunt dissector, or with the handle of a knife, and after tearing through the tissues in this way the vein will be exposed. It is always desirable, if possible, to find the lowest gland which is affected, at this stage of the operation, so that the whole mass may be turned upwards and removed. Sometimes, however, this cannot be done, and the mass should then be divided across between the glands, the lower chain of glands being secured with pressure forceps. An attempt should now be made to strip the glands forwards and upwards with the sheath of the vein, thus freeing completely the lower pole of the tumour. Occasionally it will be found that glands are intimately adherent to the vein itself, and in such cases the vein should be thoroughly exposed below the tumour, and two ligatures passed around the vein, care being taken not to include in the ligature any of the important nerves, which lie in such close relationship to it. The vein is then divided across, between the ligatures, and turned upwards and forwards with the glands. At this stage of the proceedings two nerves must be avoided, the descendens hypoglossi and the vagus. The next stage of the operation is to search for the spinal accessory nerve

as it enters the sterno-mastoid muscle; to do this it must be borne in mind that the spinal accessory nerve leaves the skull at the jugular foramen and passes backwards to enter the deep surface of the muscle about the level of the angle of the jaw. It will usually be found passing through the glandular mass, but, strangely enough, it is hardly ever affected by the disease, and when it has been found at its point of entry into the muscle, it will usually be possible to find a sort of fascial tunnel running through the mass between its component glands. A blunt dissector is passed along this tunnel and its superficial floor cut or torn through. When the nerve has been satisfactorily exposed and freed from the glands, it is gently pulled downwards and the mass slipped under it, so that the subsequent stages of the operation can be completed without risk of injury to the nerve.

This manipulation must be conducted with great gentleness, for although a nerve is comparatively a tough structure and very considerable force is required to actually break it across, yet it is very easy to cause rupture of its axis cylinders, and consequent impairment of its function. It is, indeed, almost impossible to handle a nerve at a surgical operation, without producing degenerative changes which would be quite readily demonstrable on microscopic examination. When the mass is too large to be slipped under the nerve, it will be necessary to separate the glandular

tumour into two portions at this level. Having in this way freed the glands below, behind, and above, the main portion can be readily removed, the anterior attachments not being very intimate.

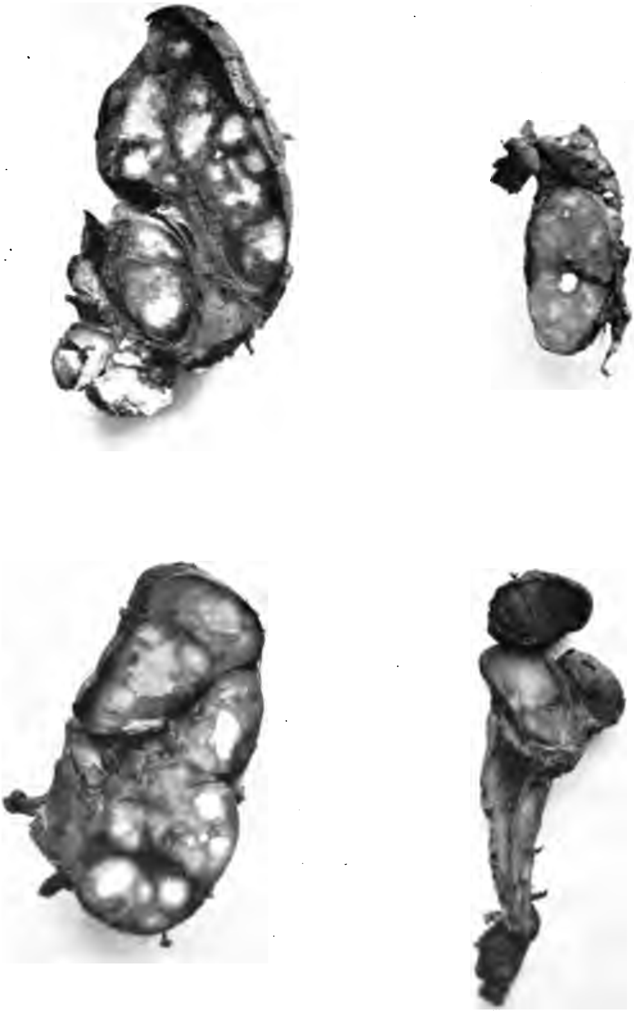
Three masses of glands will at this stage in all probability have been left behind; the lower one trails along the jugular vein, and can usually be stripped from this structure quite readily, and with a little blunt dissection followed down to the root of the neck and removed. The remaining glands lie above the spinal accessory nerve, and these it is often very difficult to remove, as they are usually adherent to the transverse process of the axis vertebra. Fortunately there are no important structures in immediate relationship with them, and if the nerve be held out of the way they can be dissected away without much fear of mischief ensuing. There remains yet another set of glands which must always be sought for and removed, namely the glands which pass backwards under the muscle, towards the posterior triangle. It is highly important to excise this group thoroughly, as recurrence frequently takes place in them. These glands are generally small and very numerous, but it is usually possible to remove them through the original incision. If the thumb be hooked into the angle of the wound the skin over the posterior triangle can be pressed forwards with the tips of the fingers, thus bringing these glands into the floor of the incision. Here again the spinal acces-

sory nerve must be avoided, as it crosses the posterior triangle from the middle of the posterior border of the sterno-mastoid to enter the trapezius.

The extent to which the glands in the neck may be affected in a case which seemed at first sight to be a comparatively trivial one, is well illustrated in Plate 9, which is a photograph of a mass of glands removed from the right side of the neck of a girl of twenty-one. She had suffered from enlarged glands for eight years. The swelling was present at the upper end of the anterior triangle, and did not at first sight seem to be very extensive, the only glands which were actually palpable being the mass marked A. When these had been excised it was found that they lay almost completely superficial to the deep fascia, and that beneath this the concatenate glands were also enlarged, and these were in their turn removed. This mass is marked B. The mass marked C is the collection of glands removed from above the spinal accessory nerve, where they were as usual adherent to the transverse process of the axis; the remaining group, D, is the chain of glands which ran down along the vessels towards the root of the neck. In this case it would have been very easy to have removed simply the first lot of glands, and then to have assumed that a complete operation had been performed; the remaining glands being smoothly packed along the great vessels and in the recesses of the neck, so that, without

A

B



C

D

Fig. 9. Caseating tuberculous glands from the neck. Natural size.

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any great carelessness on the part of the operator, they could have been overlooked.

It is only by carefully bearing in mind the general distribution of these glands and by exploring systematically the regions in which they may occur, that mistakes can be avoided. It is also perfectly evident from the above, that if the glands have been allowed to progress and suppurate, any attempt to remove the whole disease by a scraping operation would have been futile.

Tuberculous glands lie among so many important structures, that the greatest care has to be exercised to prevent injury to them in the course of an operation. Occasionally in turning the glands upwards and forwards, the surgeon is met by a violent gush of dark-coloured blood, coming either from the internal jugular, or more commonly from some branch that has been torn off at its attachment. The amount of haemorrhage is often alarming, but it very rarely gives rise to any serious trouble. If the opening into the vein can be seen, it can be secured with forceps and ligatured; if, however, as often happens, the opening is at the bottom of a crack running up beneath the mass of glands, it is impossible to see the bleeding point at once. In these cases, a piece of sponge or a strip of gauze is packed firmly upon the bleeding point, and the operation proceeded with, the glands being freed from some other point. When the glands are removed the bleeding point will be fully exposed and can be

easily secured and tied. If the vein itself is torn it may suffice, if there is only a small hole, to apply a lateral ligature, but if the wound is at all extensive, the vein should be ligatured in two places and a portion taken away. A more troublesome complication is caused by haemorrhage from the upper end of the jugular vein, which is occasionally torn close to the base of the skull while attempting to detach firmly adherent glands. Sometimes it is possible to catch the bleeding vein with pressure forceps and apply a ligature. If this cannot be done, a fully curved needle threaded with catgut should be passed through the tissue on either side of the vein, and the loose fascia sewn over the end. In this way it is usually possible to close the vein without serious loss of blood.

If everything fails packing must be resorted to.

It should be remembered that simple loss of blood is readily recovered from, and the temptation to abandon the operation on account of haemorrhage from big veins, should not be yielded to without good cause. Bleeding from the jugular vein is often alarming, and the loss of blood is often so rapid that for a short time the patient's condition seems almost hopeless. After a few minutes, however, the pulse improves, and the patient leaves the operating table very little the worse for the haemorrhage; showing that it was the suddenness of the loss of blood, rather than the amount, which produced the collapse. It is as well to administer

a saline injection per rectum as soon as the patient is back in bed.

The venous anastomosis in the head and neck is so free that the ligature of both internal jugulars seems to have no ill effect.

In operations upon the upper part of the anterior triangle of the neck, it is common to get in contact with the branch of the facial nerve which supplies the lower lip. Although the nerve may not be actually divided it may be injured to such an extent that for a time nerve impulses do not pass along it, and in consequence, for some weeks after the operation, there is a drooping of the lip at the corner of the mouth on the side operated upon. Although this produces a very marked deformity of the mouth, it need cause no anxiety, as it always recovers after a few weeks.

Another nerve which may be injured is the spinal accessory. As this nerve is only one of the nerves which supply the trapezius and sterno-mastoid muscles, division of the nerve is not necessarily followed by any ill effects. It is perhaps most commonly divided after it has left the posterior border of the sterno-mastoid, for here it is rather less constant in its relationships than at its point of entry with the muscle, and, furthermore, the surgeon is frequently working at the bottom of a deep hole when removing the glands in this situation. The moment of injury to the nerve is marked by a rapid shrug of the shoulder, and when

this occurs, even if the nerve has not been seen, it must be carefully sought for, and if actual division has occurred the divided ends immediately secured. The operation can then be completed, but before the wound is closed the divided ends of the nerve should be carefully sutured. Suture of this nerve is not particularly easy, as the nerve is only about the size of an ordinary wax match. If sufficiently fine suture material is not at hand it is always easy to obtain this by unravelling the strands of a thicker piece of silk. Silk, such as is used for suture of the skin, is usually composed of three threads twisted together, and one of these forms an excellent material for suture of these small nerves. A fine curved needle is threaded with fine silk and passed through the connective tissue sheath of the nerve, avoiding as far as possible the inclusion of any actual nerve fibres in the stitch.

This stitch (*a*) is now firmly tied, and one end cut short. The process is now repeated with the other end of the nerve, and the two threads tied together sufficiently tightly to allow the cut ends of the nerve to touch. A third suture (*bb*) is now taken and passed through the sheath of one end of the nerve, emerging at the middle of the cut surface; it then enters the cut surface at the other end and emerges through the sheath at a point corresponding to that at which it started.

This suture is now tied without much tension, its

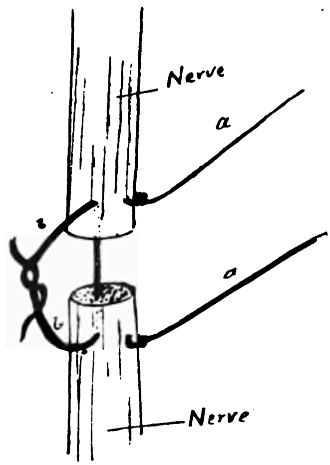

FIG. 10. Method of suturing a small nerve such as the spinal accessory.

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purpose being to keep the fibres in apposition, relying for strength upon the sutures which were previously passed. Other nerves, such as the hypoglossal, vagus and descendens hypoglossi, frequently appear in the wound, but there is very little risk of injuring them. The superficial branches of the cervical plexus which wind round the posterior border of the sterno-mastoid frequently get divided, but as their area of supply overlaps considerably, division of a few fibres is of little consequence. The operation being completed, all haemorrhage is carefully arrested and the wound sutured. Various devices have been introduced for suturing the wound, which must be briefly considered.

For a neat scar, whatever method of suture be adopted, it is always necessary there should be no tension on the stitches, since if this exists they cannot be removed with safety until the wound is perfectly healed. The tension further causes a certain amount of sloughing of the skin in the line of the stitch, which produces an unsightly and conspicuous scar. Tension is best obviated by careful suture of the platysma and cervical fascia. Closure of the skin can be very conveniently made by means of very fine silk or horsehair and an ordinary sewing-needle, using the common blanket stitch. When the wound is curved this is probably the best of all methods; the stitch-marks left by a round needle which pushes the tissues aside are much less noticeable than those left by a triangular needle

which makes an actual cut, and if the stitches be inserted quite close to the margin of the skin the edges can be brought together without any tension whatever. These stitches should be removed on the fourth day, and when the wound has been carefully dried a layer of sterile gauze is laid across the incision and a belt of collodion about two inches wide painted on nearly up to the incisions. The object of this is to support the edges of the wound and protect them from injury. At the end of four days the epithelium over the wound is usually found completely healed, but the deeper structures are still connected by very fragile granulation tissue, and it requires very little force to break it down; therefore, unless supported by a layer of gauze and collodion, movements of the head might cause the wound to reopen. Over the gauze, which is fixed with collodion, a small dressing should be applied, and over this wool and bandages in the usual manner.

If there is much oozing, or if glands have been ruptured which are the seat of a mixed infection of tubercle bacilli and pyogenic cocci, draining for a couple of days is advisable, but this need interfere very little with the ultimate result. Before the tube is put in, a couple of loose sutures of horsehair are inserted, close to the edge of the wound, in such a way as to completely close the opening left for the tube when they are tied. These are left long, and their ends knotted together. When the tube is removed

they are tightened and the hole in the skin closed. The stitches should be left for about six days.

Michel's clips are often employed, and give very satisfactory results. These consist of small pieces of soft metal with an incurved point at each end. The edges of the wound are held together by picking them up to form a sort of fold; the clip is then taken up in a pair of forceps which are specially made to fit, and bent so as to hold the edges of the wound together. Only as many clips as are necessary to hold the epithelial edges together are applied, and at the end of the operation there is a projecting ridge, with the line of incision along the top, held up by small metal arches. This ridge rapidly flattens out when the clips are removed, which should be done about the fourth day. The removal is effected either by inserting a small hook into the opening at each end of the clip or by the use of special instruments made for the purpose. If neither of these are at hand, one blade of a Spencer Wells forceps is thrust underneath the arch of the clip: closure of the forceps will now straighten out the clip and liberate its sharp points. When the clips are removed, it sometimes happens little pressure sores are found where their ends have touched the skin. These, however, disappear readily, leaving a very inconspicuous scar.

Subcuticular suture is a good method of closing wounds, but it is only applicable to a perfectly straight

wound, and, as has been seen, a straight incision for the removal of cervical glands is one to be avoided whenever possible.

In this method of suturing, a fine straight needle is taken armed with a strand of silkworm-gut. The needle is entered at one end of the wound through the dermis, parallel to the line of incision, and is brought out a little further along the wound at the same level; the needle is then drawn through, leaving a long end of the silkworm-gut behind, which is secured with a pair of pressure forceps. The edges of the wound are next held together and the point noted which corresponds to the point at which the suture left the first side of the incision, and the needle entered here and passed along in a manner precisely similar to the first stitch, for about a third of an inch. This process is repeated along the whole of the wound, with the result that the wound is held together by a number of strands of silkworm-gut, which pass transversely across the wound just beneath the cuticle. When the suture is completed the two ends are pulled upon, and by straightening out the piece of silkworm-gut the wound is accurately closed.

When the wound has been closed a dressing is applied which may be according to the individual taste of the operator, but none perhaps yields so uniform a result as one composed of a mass of cyanide gauze, which has been wrung out of a 1 in 4,000 solution of per-

chloride of mercury. Over this a large mass of wool is applied. Whatever material be employed for the dressing it should be a large one, not only because a large dressing is safer from an antiseptic point of view, but also because a big mass of wool acts to a certain degree as a splint, and keeps the parts at rest. If there has been much oozing, it is as well to apply a little pressure to the wound so as to keep its superficial and deep surfaces in apposition. This can be done either by the arrangement of the dressing in the form of a graduated pad, or by incorporating one or two sterilized marine sponges, squeezed as dry as possible, among the outer layers of the gauze. After the bandage has been applied a strip of broad elastic should be arranged around the neck so as to further aid the compression, and to keep the bandage in its place during any movements of the neck.

The patient should be kept in bed for about ten days, and during this time, although the wound may be completely healed, a large dressing should be kept on.

When the main source of infection is in the posterior triangle it will be usually found, at any rate as far as tuberculosis is concerned, that the main mass is situated towards the lower end of the triangle; and the glands can be very conveniently exposed through an incision carried almost transversely round the neck from the anterior border of the trapezius. In this region, especially upon the left side, it is very important not to

attempt to perform the operation through too small an incision, as a number of structures come into the field of operation which it is extremely dangerous and troublesome to wound. Separation of the glands should be commenced by finding the fibres of the trapezius muscle, and an attempt should then be made to turn the mass of glands forwards. The structures to be borne in mind more particularly are the great veins of the neck, the phrenic nerve, and the thoracic duct.

Having freed the glands posteriorly, the fascia is divided along its attachment to the clavicle, and an attempt made to separate the glands from below. In this region the knife should be used as little as possible, and in no case should its point be allowed out of sight. It will be found that in attempting to displace the glands upwards a wall of fascia will be met with, which seems to extend from the lower border of the mass and to end vaguely in the structures at the root of the neck. Although a large number of important structures lie beneath this fascial wall, it may be quite impossible to make out the exact position of any of them, and as the glands are held up in the attempt to separate them, knowledge of the exact anatomical relationships is of very little use. The temptation to divide this layer of fascia across should not be yielded to, as in all probability this will result in the division of some important structure. A blunt broad dissector is taken and the wall of fascia torn through from below

upwards, the dissector being moved in the direction of the long axis of the body; this will leave a series of fascial bands, and the blade of the dissector can be gently insinuated beneath, and, when it is certain that they consist of nothing but fascia, they may be divided. By proceeding in this way it is possible to separate the glands from below. When this has been satisfactorily accomplished the great difficulty of the operation has been overcome, and the dissection may be carried onwards towards the anterior part of the field of operation. Here it is very frequently possible to shell out this corner of the mass without difficulty; but if there is much adhesion, or any doubt as to the relationship of the other structures in the neck, more room and better exposure should be obtained.

This is readily secured by division of the fibres of the sterno-mastoid muscle, sufficient of the lower end of the muscle being left, however, to allow the surgeon to suture the two ends together comfortably. If glands are now felt extending downwards into the superior mediastinum, it is doubtful whether an attempt should be made to remove them. If they are not very adherent and can be detached by a process of combing out their fascial attachments with a blunt dissector, this may be done, but it is rarely worth while to expose the patient to any great risks for this purpose. In the upper part of the incision the dissection will follow the lines already laid down in removal of glands in the

anterior triangles. In the depths of the wound it will sometimes be found that the thoracic duct is exposed, and every care should be taken to preserve this structure, which enters the junction of the jugular and innominate vein on the left side. Wounds of this vessel are considered in another section.

The most dangerous accident that can occur in this region is the entry of air into the great veins. This occurs most frequently when a wound is made in the innominate or internal jugular vein, but it occasionally happens that some of the smaller veins, such as the supra-scapular, are surrounded with so much inflammatory material that they are converted into rigid tubes, and air can enter when they are divided. When this occurs a peculiar hissing sound is heard, the patient becomes almost immediately cyanosed and pale, the respirations are deep and laboured, but there is no stridor, and it is evident that the air is freely entering the lungs. The pulse falls rapidly, and unless the condition is promptly recognized and treated death follows almost immediately. The first line of treatment as soon as any suspicious noise of this kind is heard, is to thrust a sponge or finger into the depths of the wound, so as to temporarily close the opening. If it is possible to compress the vein below the opening, this may be done, a pair of pressure forceps applied, and the opening permanently closed; if, however, it is impossible to do this, a strip of gauze should be lightly

packed into the depths of the wound, and left in position for forty-eight hours. When only a small quantity of air has entered, although the patient's condition is extremely alarming, he will probably recover in a few minutes. The respiration may be assisted by administering oxygen, and the heart supported by hypodermic injections of strychnine; these, however, are of not much assistance, as there is plenty of air entering the trachea, and the dyspnoea is caused by the small bubbles of air which plug up the pulmonary capillaries.

If operation be postponed the glands will continue to enlarge, and ultimately it will be possible to make out a definite, soft spot in one of the glands. When the case is seen for the first time at that stage of the disease, one is often tempted to regard this as a simple unilocular abscess; but it must be borne in mind that the single broken-down tuberculous gland, for all practical purposes, does not exist. When the skin is not involved, or when the skin is only affected over a small area, so that a complete operation would not entail the removal of a piece of skin more than half an inch wide, operation may be proceeded with; but when the skin is affected, reddened, and thinned over a wide area, it is often better practice to incise the abscess, thoroughly scrape away the lining membrane, and wait for the cavity to close. It is sometimes possible to suture the incision, and, whenever the cut edges of the skin are not so affected with the disease that it is obvious they

would not unite, this should be done. After the abscess has been curetted a sponge is packed firmly into the cavity and all oozing is arrested. The sponge is then removed, and a number of silkworm-gut sutures passed, one of which is left loose after the rest have been tied. Through the opening thus left the nozzle of a syringe charged with an emulsion of Iodoform and Glycerine[1] is inserted, and the abscess cavity distended with the fluid, so that all its recesses are satisfactorily reached. The excess of emulsion is allowed to escape, and the final suture tied. The wound is then dressed and bandaged. The dressing should be renewed every other day, and in the majority of cases healing takes place readily.

The question of further treatment has now to be considered. If the wound heals the remaining glands should be excised as soon as cicatrization is completed, that is to say in a month or six weeks. If a sinus persists, this should be allowed several months to contract, and if it shows signs of healing, operation should be postponed until this has taken place. When the improvement seems to have come to a standstill, there is no advantage to be gained by further delay, and the whole glandular area should be thoroughly cleared out.

[1] Formula of Iodoform Emulsion:

Hydrarg. perchlor.	1 part
Iodoform	200 parts
Glycerine	1800 parts

When, however, the skin over the swelling is thinned and red, it is practically certain that there is a mixed infection; and in these cases it is not advisable to suture the incision in the manner described. After the pus has been evacuated, the whole of the abscess cavity should be very thoroughly curetted so as to remove its lining membrane completely. Drainage must be provided for, and this is best done by means of a rubber drainage tube, which can be removed as soon as the discharge has become serous. If there is a large cavity and there is much oozing, it is sometimes advisable to pack the cavity firmly with gauze. Before doing this a number of silkworm-gut stitches should be passed through both lips of the incision, so as to bring them into apposition when the sutures are tightened. At the end of twenty-four hours the dressing is changed, but the packing is left in position. The next day the whole of the packing should be removed, a drainage tube inserted, and the sutures tightened. Too much stress cannot be laid upon the necessity of applying a sufficiently large dressing in these cases; for even when there is undoubtedly a mixed infection, the virulence of the secondary organism is usually slight, and if asepsis be maintained the septic factor in the case is very rapidly eliminated, and healing of the wound is usually satisfactory.

Rapid healing, however, occasionally fails to take place, and this is due to one of two causes. In the

first of these the antiseptic technique has been imperfect or the drainage has been inefficient. Cases are sometimes seen in which an abscess has been opened, a small wick of gauze inserted as a drain, and a dressing applied which only covers the mouth of the sinus; such cases often recover rapidly if the irritating gauze be removed, the skin disinfected, and an efficient dressing applied.

The second cause of failure is less easily dealt with, as it is due to the persistence of caseating material at the bottom of the wound. When a mass of tuberculous glands breaks down, the pus finds its way through the deep fascia and reaches the subcutaneous tissue by passing round the sterno-mastoid muscle, or actually through its anterior fibres; a large collection of pus is thus formed which communicates with a second abscess cavity beneath the deep fascia. Curettage of the superficial abscess will leave the deeper portion untouched, and in these cases healing only very rarely occurs. The superficial cavity usually contracts down to a small sinus, opening in the middle of a puckered scar, and a radical operation is necessary before the case can be brought to a satisfactory termination.

When there is a sinus which refuses to heal, a radical operation is performed in the following way.

The patient is anaesthetized, and the skin disinfected in the usual way. The sinus is then scraped out as thoroughly as possible, and a small piece of sponge held

in pressure forceps is then taken, dipped in pure carbolic acid and thrust into the opening of the sinus, care being taken to prevent the strong acid running over the adjacent skin. After the sinus has been cauterized in this fashion, an incision is made around the opening of the sinus at a distance of about a quarter of an inch. The edges of the little island of skin produced in this way are now sutured, so as to invaginate the opening of the sinus and to close it completely. The skin at the side of the neck is now re-disinfected, and fresh instruments taken for the rest of the operation. The incision is enlarged in accordance with the directions already laid down, and the dissection of the triangles of the neck proceeded with.

It is a good plan to carry the incision completely through the deep fascia at the lower and anterior portion of the wound, before attempting to dissect out the sinus itself, as this not only affords information as to the relationship of important structures, but also enables the operator to get beneath the mass of enlarged glands and, by a dissection conducted alternately from its deep and superficial aspects, to excise the sinus without opening it. The dissection differs but little from that in clean and straightforward cases, but there is always condensation of the fibrous tissue, making blunt dissection much more difficult, and necessitating a free use of the knife. If the sinus should be opened inadvertently, the pus should not be sponged

away, as this tends to rub the contained organisms into the tissue spaces, but it should be washed away by squeezing a copious amount of lotion over the wound. When the operation is completed the wound may be sewn up in a method similar to that already described. The platysma should be sutured as far as possible, but the dissection of the sinus will probably have entailed removal of so much of the muscle, that this cannot be done as satisfactorily as in a quite clean case. The skin should be sutured with a round needle and horsehair, and a drainage tube put in at one end of the incision. A loose suture can be left at this point, so that it can be tightened up when the tube is removed.

The case should be dressed daily; and if at the end of the third or fourth day the discharge from the tube is found to be serous, and not very copious, the tube may be taken out and the loose stitch tightened. If, however, the discharge is purulent, the drainage tube should be left in longer, and gradually shortened as the wound heals.

Cases conducted on these lines very rarely give any trouble, and infection of the cellular planes of the neck practically never occurs.

Perhaps the most difficult type of case to deal with is that in which the glands have ruptured at several points producing infection of the skin around the openings of the abscess cavities, and giving rise to extensive tuberculous ulceration of the skin. The

patient also is pretty certain to be broken down in health, and readily affected by any type of infection. The first line of treatment is to attack the superficial ulceration, and by curetting the granulating floors of the ulcers, and the opening of the sinuses, it is frequently possible to improve the condition very materially. The patient's general health must receive every attention, and this treatment should be conducted along the lines already laid down for cases in which it is hoped to obviate an operation. As soon as the superficial ulceration has healed and the surgeon has to deal merely with deep glands and sinuses, a radical operation should be attempted.

It is difficult in these cases to give accurate directions for planning the incision, as the positions of the sinuses vary in every case: and the surgeon's ingenuity may be taxed to its utmost in devising an incision which shall give access to the glands and provide for the excision of the sinus. The operation itself is simply a complicated variety of that described above, but the drainage provided should be more efficient, and it is not possible to obtain such a neat scar. The drainage tube should always be inserted at the lowest portion of the wound; a separate opening being made if necessary, or the opening in the skin left after excision of one of the sinuses utilized for this purpose. The wound should be closed by interrupted sutures of silkworm-gut, which should be passed through the

skin about half an inch from the edge of the incision, so as to hold the skin together even when a certain amount of infection has taken place. If fine sutures are used and passed through the very edges of the divided skin, they have a tendency to slough out completely, and thus allow the wound to break open. The case should be dressed in the usual way, and the sutures removed about the tenth day. The tube should be shortened as the wound heals.

The treatment of tuberculous glands in other regions of the body is conducted on exactly the same lines, but there are, of course, differences in the details of the operative treatment.

When the main focus of infection is in the submaxillary region the glands should be exposed through a slightly curved incision extending from a point just behind the angle of the jaw down to the level of the greater cornu of the hyoid bone, curving forward from this point as far as the size of the swelling demands. A flap of skin is thus turned up and the deep fascia divided. In this region it is not usual to meet with any very important structures, at any rate towards the anterior part of the wound, but it should be remembered that the glands will very probably be found extending back to the line of the great vessels. It is often possible to remove these through the incision already described, but the surgeon must be prepared to find the extent of the glandular enlargement out of all

proportion to the amount of swelling which could be felt before the commencement of the operation.

The flap of skin having been turned up, an attempt is made to define the lower border of the mass. Having in this way found the deep limit of the tumour, the posterior portion of the mass should be defined. If it is found possible to secure the most posterior gland of the affected group, this should be shelled out of the fascial structures around it and turned forwards. If the surgeon now finds that there is also extensive involvement of the glands of the anterior triangle, an attempt should be made to expose these glands through the same incision, retracting the lower edge as far as possible.

The lower and posterior borders of the tumour being defined, the whole mass is turned forwards, when another point presents itself for consideration, namely whether the submaxillary salivary gland should be removed or not.

It very frequently happens that there is a lymphatic gland at the hilus of the salivary gland which is affected by the disease, and in these cases it is perhaps wise to remove the salivary gland as well; this seems to lead to no unpleasant consequences, as the remaining salivary glands seem to be quite competent to carry on the work of these structures. In removing the salivary gland it must be remembered that the facial vein lies superficial to it, and that the facial artery

lies in a groove on its deep surface. The mylo-hyoid nerve is in close relationship with its deep surface, and towards the posterior part of the incision a short extent of the hypoglossal nerve may be exposed. It is usually quite simple to avoid injuring the nerve, and very frequently the artery can be lifted from the groove beneath the gland and preserved. There is, however, no objection to ligature of the artery when it is at all necessary.

If the glands which lie along the great vessels cannot be removed through the incision which has been already made, a second incision should be made parallel to the first and at a lower level in the neck, the stages of the operation conducted through this, being exactly the same as have been described in the previous section.

This plan of a second incision is much to be preferred to an angular incision extending downwards from one end of the first incision. It may seem to involve a greater mutilation, but in reality the resulting scar is much less prominent.

Another gland which frequently requires excision is the small gland in front of the ear. Removal of this gland is a comparatively simple matter, but on its deep surface it tends to get into close relationship with the fibres of the facial nerve. It is best removed through a horizontal incision, so as to avoid as far as possible the division of the fibres of this nerve.

CHAPTER XII

THE OPERATIVE TREATMENT OF TUBERCULOUS GLANDS (*continued*)

Tuberculous glands in the axilla are by no means rare, but not commonly as a primary lesion. They are frequently found with other forms of tuberculosis. Their removal is conducted on lines similar to those already laid down for the removal of cervical glands. The best incision is one which starts just posterior to the brachial artery and, curving forward along the axillary border of the pectoralis major, terminates at a corresponding point on the opposite side of the axilla. This enables a flap to be turned backwards and downwards, exposing the whole contents of the axilla. This incision is very much better than one made in a straight line along the middle of the axilla, since any straight incision in this neighbourhood tends to contract and form a web-like structure which impairs the movement of the upper arm. If only a small gland has to be excised this is not of much moment, but even in this case it is as well, if possible, to make the incision transverse. The glands are freed from below upward, the first stage being

a division of the deep fascia of the arm, and the identification of the vein. There are no important structures to be considered in front, and here the dissection is usually carried out quite simply. On the thoracic side the position of the nerve of Bell running along the attachment of the serratus magnus must be borne in mind, as division of this nerve leads to paralysis of the muscle and much consequent disability. The difficulty in detaching the glands arises from the fact that they frequently run up into the neck, passing up behind the clavicle to join the glands in the posterior triangle of the neck. If there are infected glands in both regions an incision can be made above the clavicle, so as to free the glands from above; if more room is required in the axilla, this may be obtained by dividing some of the fibres of the pectoralis major, and subsequently suturing them together.

SUPRA-CONDYLAR GLANDS

It is rare to find these glands affected in tuberculosis, but the condition is occasionally met with in connexion with tuberculosis of the bones of the hand. They can be removed most readily through a straight incision over the most prominent part of the tumour.

INGUINAL GLANDS

Although these glands are much less liable to infection than the cervical glands, they are occasionally the seat of

tuberculosis. In many cases in which the cervical and axillary glands are affected these glands are enlarged also, but here the disease is rarely of any moment, usually subsiding as the patient's general health improves. This group of glands, draining as it does the lymphatics of the whole of the lower extremity, the perineum, and the lower part of the abdominal wall, is frequently the seat of chronic irritation, and hence forms a likely nidus for the deposit of the tubercle bacillus. Again, tuberculosis is by no means uncommon in the area drained by these glands, and tuberculous ulceration about the rectum, for example, is responsible for a certain number of cases. Strangely enough, it is rare to find these glands enlarged in tuberculous disease of the joints.

Removal of the glands is best carried out through a curved incision, with its base downwards and inwards; the object of this being to carry the bulk of the incision as far away from the perineum as possible. Removal of these glands is usually quite a simple matter. Detaching the glands and turning them upwards, they should be freed from below, defining the internal saphena vein and the femoral vein; care should be taken not to wound these structures, as an obstruction to both the venous and lymphatic flow may lead to very troublesome swelling of the leg.

THE POPLITEAL GLANDS

These glands are not commonly enlarged in tuberculosis, but when this occurs they should be excised. It is well here, as in the case of the axilla, to avoid a straight incision. Exposure of the glands by means of a flap turned aside from the whole popliteal space being preferable. The base of the flap can be made either inwards or outwards, and there is then usually little difficulty in clearing out the whole of the fat and glands in the popliteal space, the dissection being conducted on the lines already laid down.

MEDIASTINAL GLANDS

Besides the glands which can be felt upon the surface of the body, the thoracic and abdominal glands are particularly prone to tuberculosis, but these are not as a rule so amenable to surgical treatment.

In the anterior mediastinum, tuberculous glands are frequently met with and may cause symptoms not only by the chronic poisoning produced by the tubercle bacillus, but also by pressure on surrounding structures. Their diagnosis is usually a matter of difficulty. Occasionally the upper end of the mass can be felt projecting into the root of the neck, just above the supra-sternal notch. It is sometimes possible to make out a slight dullness on percussion over the

manubrium sterni and in some cases a loud, buzzing bruit can be heard over the root of the great veins, when the patient's head is fully extended. Suppuration occasionally occurs in these glands, and in such cases the abscess may point either through or at the side of the sternum ; in some cases it may run along under the costal fascia and point some little distance from the lateral margin of the sternum.

The following case shows the way in which these abscesses may track for some distance. A girl aged eight was brought complaining of a uniform, painless swelling of the left breast. With the exception of the swelling she had no symptoms of any kind ; her general health was excellent. The right breast was perfectly normal, but the left was as large as that of a girl who had just passed puberty. On examination it was seen that this swelling was due to a collection of fluid immediately behind the nipple, and it seemed probable that this was due to a tuberculous abscess springing from a rib.

Accordingly a curved incision was made at the periphery of the swelling along its lower and outer borders, and the whole breast and skin turned upwards and inwards, so as to avoid injury to, or deformity of the gland. The superficial abscess cavity was excised, and an opening was then found leading towards the back of the sternum. A piece of rib was excised to enable this to be laid open, but no disease

of rib or sternum was found, the cavity leading directly into the mediastinum, where the disease had obviously started from the lymphatic glands.

The opening was then thoroughly scraped out, and a drainage tube put into the bottom of the wound, so as to carry off any blood or serum which might exude. The wound around the drainage tube was then sutured. After forty-eight hours the tube was removed, and in a few days the whole wound had healed, the patient making an excellent recovery.

Glands in the posterior mediastinum are very common, and form the starting-point of many cases of pulmonary tuberculosis in children. They are unfortunately not amenable to surgical treatment, but are of importance inasmuch as they are in intimate relationship with the thoracic duct, and through this structure frequently produce a disseminated miliary tuberculosis.

Tuberculosis of the Mesenteric Glands is extremely common, especially in children. The infection probably comes in every case from the intestinal mucous membrane; but it does not seem to be common for actual intestinal tuberculosis to exist at the same time. Infection of the peritoneum with miliary tubercles, spread over the surface of nearly all the viscera, is very commonly associated with glandular enlargement; but in many cases in which the mesenteric glands are enlarged there is no affection of the peritoneum. Diagnosis of the glands may be

simple, or extremely difficult, according to whether the mass of glands has produced a definite tumour, or the disease has spread over the whole of the intra-abdominal glands without very much enlargement of any of them.

In all cases, in which glands are to be felt in any of the regions of the body where they are readily accessible, an abdominal examination should also be made, as it is quite common to find the abdominal glands enlarged without the production of any definite symptoms. However, occasionally definite symptoms are produced. The patient becomes emaciated, loses his appetite, and his general aspect suggests that there is some profound disturbance of nutrition. Unless glands can be actually felt, it is not easy to be certain that the source of trouble lies in the mesenteric glands, but a hint is sometimes to be obtained by a process of exclusion: for example, cases are occasionally met with in which wasting and malnutrition occur, and in which the characteristic appearances of the patient who is badly defended against tuberculosis are strongly marked. Such a child is thoroughly examined, and nothing found, with the possible exception of slight enlargement of the inguinal glands; more careful search may reveal some enlarged glands just above Poupart's ligament. Abdominal disturbances are common, slight attacks of diarrhoea occurring without any obvious cause, and in some

cases actual abdominal pain. In these cases it must be remembered that the tuberculous disease is in very close relationship with the peritoneum, and there is no doubt that the disease-resisting power of this membrane is higher than any other structure in the body. Abdominal tuberculosis has therefore a natural tendency towards recovery, and if the patient can be put under good good hygienic conditions recovery can usually be obtained.

The possibility of recovery in this way was well shown in the following case: A young man aged twenty-one, who had led a comparatively sedentary life, had several attacks of acute abdominal pain, which were diagnosed, accurately, as the event showed, to be due to appendicitis. A puzzling feature of the case, however, was that just at the outer border of the right rectus, a tumour about the size of a fist could be felt, well above the tender area around McBurney's point. This tumour was not connected with the anterior abdominal wall, did not move on respiration, and was slightly attached to the posterior abdominal wall. The abdomen was opened at the outer wall of the right rectus, the appendix was brought up into the wound, seen to be obviously diseased, and excised. The tumour was found to be a mass of glands, probably tuberculous, situated in the ascending meso-colon, to which portion of the bowel it was intimately adherent; the condition presented a very close parallel

to that which occurs in the case of enlarged cervical glands; that is to say, there was a chronic source of irritation in the shape of the appendix, and very probably also some tuberculous ulceration of the large intestine. It was perfectly obvious that any attempt to remove the tuberculous mass without excising a considerable length of the ascending colon was impracticable, and accordingly, after the appendix had been removed, the abdomen was closed, in the hope that removal of the chronic irritation which had been obtained by the incision of the appendix, combined with general hygienic treatment, would result in a disappearance of the mass. The wound healed normally, and for three months after the operation the patient was kept at rest upon his back, with his bed drawn up to an open window overlooking the sea. His diet was regulated, so as to gain full nutrition, while at the same time preventing intestinal disturbances. As a result of this treatment the lump began rapidly to diminish, and at the end of three months could no longer be felt. The patient was then sent for a sea voyage, and on his return was found in excellent health, with no appearance of the lump, and with no abdominal symptoms. Occasionally the progress of recovery of mesenteric tuberculosis is not so satisfactory, and the glands break down and form abscesses which are seen in the form of abdominal tumours, the nature of which is often extremely

uncertain before operation. Sometimes definite cyst-like structures are formed.

The surgical treatment of this form of tuberculosis is very difficult and unsatisfactory. Attempts have been made to excise the glands, but their relationship at the root of the mesentery with the sympathetic nerves and the mesenteric blood-vessels, renders their extirpation very dangerous. When a definite abscess is found there is no objection to incising and scraping this out; if large cysts form, these can be incised and stitched to the peritoneum of the abdominal wall: these cases are, however, exceptional. The general rule is that in mesenteric tuberculosis the patient either recovers under medical treatment or dies of acute tuberculosis.

CHAPTER XIII

THE VACCINE TREATMENT OF TUBERCULOUS GLANDS

Within the last few years, the researches of Douglas and Wright have confirmed the idea that recovery from bacterial disease is very largely brought about by the phagocytic action of the white blood corpuscles, and possibly also of some of the cells of the connective tissues. A normal blood-cell, however, separated from the blood serum and suspended in an isotonic saline fluid, exhibits no phagocytic action, or at least very little, when the bacteria presented to it are in their natural state. If, however, some blood serum be mixed with the emulsion of bacteria, there is a substance in the serum which acts upon the bacteria in such a way as to make them easily ingested by the leucocytes. This substance, or rather group of substances, have been termed opsonins, and Wright and Douglas maintain that their action is entirely upon the bacteria, and in no degree upon the leucocytes. In order to study this phenomenon of increased phagocytosis, a mixture is made consisting of the corpuscles of a healthy individual, the blood serum of a healthy individual, and

an emulsion of tubercle bacilli in saline solution; a second mixture is prepared, using the same lot of white corpuscles and the same emulsion of bacilli, but replacing the serum of the normal individual by the serum of the patient under observation. The mixtures are then kept at blood-heat for a quarter of an hour, and at the end of this time smear preparations are made and stained. When these are examined under the microscope, it will be found that most of the white corpuscles have taken into their cell-substance one or more of the tubercle bacilli. Forty or fifty of these leucocytes are examined, and the total number of bacteria found within them counted. By dividing this total number of bacteria by the number of corpuscles examined, the average number of bacilli per corpuscle can be ascertained and compared in the two cases.

The number found in the specimen which contains the normal serum is taken as the standard, and the other is expressed in fractions of this. Thus, if the mixture containing normal serum exhibited an average of 4 leucocytes per corpuscle, while the mixture which contained the patient's serum exhibited an average of 2 bacilli per corpuscle, this fact would be expressed by saying that the patient had an opsonic index of ·5.

As has been mentioned, these observers maintain that the presence of this substance—the opsonin, which by its action on the bacteria facilitates phagocytosis—

is essential for the destruction of tubercle bacilli, and consequently for the recovery of the patient. They have further found that if an emulsion of dead tubercle bacilli be injected subcutaneously into the body, the whole disease-resisting mechanism of the body is stimulated, with the result that the amount of opsonin produced is increased, and in consequence the opsonic index rises.

They have found that the rise is preceded by a well-marked fall, and the period during which the amount of available opsonin is below the normal they call the *negative phase.*

It is obvious that if a second dose of the bacilli be injected during the negative phase, the opsonic index will fall still lower, and the super-position of negative phase upon negative phase will produce a state in which the phagocytic action of the leucocyte is completely abolished. If, however, the second and subsequent injections be given during the opposite or positive phase, although there will be a corresponding fall in the index, the subsequent rise will carry it beyond the point to which it rose after the first injection. In this way it is possible to keep the opsonic index of the patient higher than normal, and, so it is maintained, to ultimately destroy the bacilli themselves and bring about recovery from the disease. It is certainly true, that when Koch introduced his method for the treatment of tuberculosis by

injecting the toxins produced by the bacilli, there was a great disparity in his results, some cases improving while others were made infinitely worse, and indeed some of them died. It is suggested that this disastrous result was brought about by the administration of the toxin during the negative phases, those cases in which good resulted owing their recovery to the accidental administration of the toxin during a positive phase. Wright's method of treatment consists, then, in the maintenance at a high level of the amount of opsonin in the blood. In some cases of staphylococcic infection the results of injecting a few millions of dead staphylococci has been very remarkable, the rise in opsonic index being accompanied by an enormous improvement in the patient's condition. In some cases of tuberculosis also, where the disease is localized and not very extensive, very excellent results have been obtained; but it must be confessed that, in the case of tuberculous glands, the hopes that were entertained of the efficiency of this method have been to a great extent disappointing. As an adjuvant to other forms of treatment, it remains very valuable, but it should not be allowed to take the place of operative interference when this would otherwise be indicated. When it is decided to carry out the treatment, the opsonic index should be estimated before commencing the injection, and after the injection has been made; the initial dose of which should correspond to about $\frac{1}{800}$th

of a milligramme of the dead bacilli. The opsonic index should be estimated every other day, so as to determine the time that the negative phase lasts.

As soon as the curve of the opsonic index has reached its acme, a fall will be noticed, and this is the indication for the second injection. This will be ten days to a fortnight after the first dose. After two or three negative-phase times have been carefully measured, it will not be necessary to estimate the opsonic index so frequently, as the time the negative phase lasts is fairly constant to the individual, although it varies considerably in different patients. An occasional estimation should therefore be made before injecting, in order to be sure that the index is not falling too low. It will be difficult to estimate the amount of benefit to be derived from a method of treatment of this kind, as tuberculous glands certainly show a tendency to spontaneous recovery.

Carefully carried out, however, the method entails no risk to the patient, and may with much advantage be employed during the time that it is uncertain whether the glands are going to break down or not. When there is distinct evidence of caseation in the glands, operation should be carried out without delay.

The opsonin is a substance which is brought to the diseased area by the blood. The caseating patches in a tuberculous gland are, however, avascular, and there is in consequence no means by which the opsonin can

gain access to the bacilli, so that benefit which might have been derived from the injection is prevented. After the removal of a gland the injections may be continued with advantage, as a method of preventing reinfection; but this point, although in accord with theory, can, from its very nature, only be proved by watching many cases, over long periods of years, and it is as yet too early for evidence of this kind to be brought forward.

There are cases in which, after opening tuberculous abscesses in the neck, sinuses persist, and around the opening of these sinuses there is extensive ulceration of the skin. These cases often do well under the tuberculin treatment. When cases, which have been treated by tuberculin injections for a long time are submitted to operation, it is found that the glands are very much more adherent to each other and to the surrounding structure than would have been otherwise expected; the fibrous tissue is very much increased in extent, even the fibrous tissue of the gland capsules and that which exists within the glands themselves in the shape of septa. Calcification is often present in cases in which the disease has not existed for any great length of time, and it is difficult to reconcile this finding with the hypothesis that tuberculin acts by altering the bacilli themselves, leading to their extermination, rather than by stimulating the tissues to resist their ingress. The conditions found are simply those which

are present after spontaneous recovery from a tuberculous lesion, although in a more marked degree. The whole problem of immunity is, however, so complex, and so little is known of the underlying principles, that it is very unsafe to argue from one fact to another.

CHAPTER XIV

DISEASES OF THE THYMUS GLAND

This organ is not one which is very frequently diseased. In common with other organs of the body it is affected in disseminated infections, such as syphilis and tuberculosis. Tuberculosis is only found in cases where the disease has become generalized, and in syphilis the only change is a certain amount of arterial thickening, and hyperplasia of the connective tissue, which are characteristic of the disease in all situations and are not peculiar to this organ.

The gland is not often the seat of an acute infection, but cases of mediastinal abscess have been reported which originated in this gland. As regards tumours, simple cysts filled with clear serous fluid have been reported in a few cases. Malignant disease may be present as a secondary deposit, when there is a general dissemination; and in common with other lymphoid structures the thymus gland may be the seat of a primary lymphosarcoma.

The most important affections of the gland are undoubtedly those in which it is the seat of a simple hyperplasia. The gland which is present at birth

reaches its maximum at the end of the second year, when its average weight is about half an ounce, and its dimensions about two and a half by one inch. It is found enlarged in some cases without any symptoms. It also persists in some cases of exophthalmic goître, and shares in the general hyperplasia of lymphoid tissue found in leukaemia and Hodgkin's disease.

A few cases have been reported in which, owing to enlargement of the thymus, a progressive dyspnoea has been produced. Siegel records a case of a boy 2½ years old, who suffered for four weeks from an increasing dyspnoea, which was obviously not of laryngeal origin. An attempt was made to relieve him by performing tracheotomy, and it was only when a tracheotomy tube was employed which reached to the bifurcation of the trachea, that air was able to enter the lungs without hindrance. The thymus was found to be enlarged and obviously pressing upon the trachea. It was dislocated from its bed, pulled upwards through the superior aperture of the thorax and sutured to the fascia of the neck. This method of treatment succeeded in relieving the dyspnoea, and the patient remained well.

This type of case is extremely interesting, especially in view of the fact that the patient survived operative interference of considerable severity; for these cases of enlarged thymus are particularly prone to sudden death, especially under surgical operation. When the

enlargement of the thymus can be diagnosed and is causing symptoms, the possibility of employing X-ray treatment should be considered, as these rays seem to have a selective action upon lymphoid tissue, which is well seen in the treatment of lymphadenoma and leukaemia.

Enlarged thymus is also associated with the condition known as the *Status Lymphaticus*. This is rarely diagnosed *ante mortem*, although attempts have been made to describe its characteristic symptoms. The patient is usually pale, with a dull, pasty complexion; the superficial subcutaneous fat is well developed, and there are usually slight signs of rickets. All the lymphoid structures which are accessible to examination are found to be enlarged, although not to a very great extent. The tonsils are big, there are small adenoid vegetations in the pharynx, and the cervical, axillary and inguinal glands are enlarged. The enlargement of the thymus gland, although constantly present, is difficult to make out; but in some cases a small area of dullness has been detected over the upper portion of the sternum; very rarely, the upper end of the thymus gland can actually be felt where it projects into the neck.

The association of enlarged thymus with sudden death still presents many difficulties, and so far, no theory has been advanced which explains the whole of the facts satisfactorily. Many of the cases, it is

true, die during the early stages of the administration of an anaesthetic, but it must be remembered that there are many cases in which death occurs, without any operation or anaesthetic. It must also be borne in mind, that there are many cases of sudden death occurring in children, the exact nature of which is undetermined; for example, children found dead in bed are often said to have been overlaid, although definite evidence of this having occurred is wanting. It is possible that many of these cases are really examples of status lymphaticus. It is true they occur almost exclusively among the poorer classes, but it is just in this section of society that glandular and lymphatic affections are so common.

If this is so, it is quite conceivable that, if accurate statistics were available as to the number of patients affected in this way and the precise cause of death known, it would be found that the administration of an anaesthetic precipitated the fatal issue in a percentage of cases, sufficiently small to suggest that there is nothing in the anaesthetic itself to cause death; the patients dying as a result of the fright and disturbance accompanying the operation. Although these patients seem to be in perfectly good health, for some reason or other their reserve vitality is very small, and any depressing cause, however slight, is sufficient to upset the balance, and kill the patient. The fact that the status lymphaticus is seldom diagnosed, except on

the post-mortem table, makes it impossible to say whether recovery from this condition occurs, but it is quite likely that in later life the patient may become strong, although, as a child, his life was in jeopardy for years. Most of the investigation and clinical study upon the status lymphaticus has produced negative results: spasm of the glottis, pressure upon the trachea and the veins of the neck, and the cardiac nerves, have in their turn been rejected as the causes of death. The fact that the respiration continues after the heart has ceased to beat, suggests that the cause of death is to be sought in the cardiac rather than in the respiratory system.

It is possible that in the status lymphaticus some toxic condition obtains. When living cells are taking their normal place in the economy of the body, there is ample provision made, not only for their nutrition, but also for disposing of their products of destructive metabolism, many of which are undoubtedly toxic: when, however, these cells are in excess of the requirements of the body, it is easy to conceive that the normal metabolic and excretory mechanisms are insufficient to deal with the toxic products of their metabolism, and hence these poisonous substances accumulate and produce toxic symptoms, analogous to those produced by a malignant growth.

CHAPTER XV

THE SURGERY OF THE THORACIC DUCT

APART from surgical operations, the thoracic duct is not very commonly injured; or, to be more exact, injury of the thoracic duct is usually associated with injuries to organs such as the aorta and vessels at the root of the neck, which are necessarily immediately fatal. Injury to the duct, without an immediately fatal result, has, however, been recorded following cuts and shot-wounds.

In one case a patient died five days after having been run over by an empty, heavy cart; at the post-mortem a large effusion was found in the right pleural cavity, which proceeded from a rent in the thoracic duct opposite the ninth dorsal vertebrae.

In another case, a girl of nine years old was pushed violently against a window-sill, striking her chest at a point opposite the third rib. After some days she began to exhibit signs of pleural effusion, and the chest was accordingly aspirated, the fluid drawn off proving to be chyle. The dyspnoea returned for a time, but the patient ultimately made a good recovery, without further aspiration.

It would appear, therefore, that it is possible for the thoracic duct to be ruptured in its intra-thoracic portion without necessarily producing death, repair taking place spontaneously. The commonest injury is that which occasionally occurs in operations upon the posterior triangle of the neck, and of this accident a considerable number of cases have been recorded. In some of them the accident has been recognized at the time of the operation, and it has been possible to see a hole in the duct from which chyle is escaping; in other cases, however, the thoracic duct is torn through, either partially or completely, while the surgeon is endeavouring to shell out the glands from the bottom of a deep wound, and the injury has not been noticed during the course of the operation.

It is important to distinguish between an injury to the thoracic duct and division of one of the large lymphatic trunks coming from the side of the head and neck. In one case a good half-inch of a lymphatic vessel was torn across, after a mass of very adherent glands had been removed from the posterior triangle. There was a fair amount of lymph escaping, both from the upper portion of the wound and also from the large trunk. The latter, however, was provided with valves only about a millimetre apart, which could be seen acting quite plainly, checking the flow of lymph but not actually stopping it. Incidentally a beautiful demonstration of the structure and degree of efficiency

of lymphatic valves was obtained. The number of valves, and the direction of the lymph stream, demonstrated that one of the main trunks had been exposed, and not the thoracic duct. The subsequent progress of the case was uneventful.

For a long time it was thought that an injury to the thoracic duct was of necessity fatal, but recent observations have shown that this is by no means the case, the fatal result being due more commonly to septic absorption from the wound than to inanition as a result of the loss of the duct contents. In cases where the injury is recognized at the time of the operation, it is sometimes possible to suture the duct, by passing two or three sutures of fine catgut through its walls. If the extent of the wound prohibits this mode of treatment, it is sometimes possible to pick up the duct and secure it with a ligature. Ligature of the thoracic duct would at first sight seem to be almost as dangerous a procedure as ligature of the aorta; but it has been successfully performed in several cases—at least nine times—and in none of these was there any untoward symptom produced by the obstruction to the lymph-flow. It is probable, as has already been mentioned, that the opening of the thoracic duct into the great veins is not the only connexion between these two systems, but that communication also exists with the azygos and renal veins. Another factor which may influence this favourable result is the fact that the thoracic duct occa-

sionally opens by two or three channels, and a wound which has been considered as one of the thoracic duct may have been merely one of these large lymphatic channels. Of the two methods, however, suture is to be preferred whenever possible.

Unfortunately, however, both of these modes of treatment are frequently impossible, since in many cases the injury is not discovered until the case is being dressed for the first time, when the wound is found distended with fluid. On separating the edges of the wound a quantity of chyle escapes. In these cases an attempt should be made by pressure, to cause absorption of this fluid, a graduated compress being applied and kept in position by a firm bandage. In a few cases this succeeds, but in others it fails, and unless prompt measures are taken a lymph fistula forms, which closes with difficulty. To prevent this, the wound should be reopened, and a firm tampon thrust down towards the site of the injured vessel. This will probably check the flow for a time, but it is very likely to recur when the tampon is removed. After a few days, however, it is usually possible to attain occlusion of the duct. The difficulty which is met with in these cases is probably due to the fact that the chyle coagulates much less readily than blood, so that it is more difficult to obtain an arrest of chyle from the thoracic duct, than of blood from a vein of a corresponding size.

Obstruction of the lumen of the thoracic duct has

been noticed, and this is frequently associated with distension and rupture of the mesenteric lacteals producing the condition known as *Chylous Ascites.* A case has been reported in which the obstruction was of congenital origin, and in this also the whole of the lymphatics of the mesentery were found to be enormously engorged. The commonest causes, however, of obstruction to the thoracic duct are pressure of tumours, for example, lymphosarcoma of the mediastinal glands, and filariae.

The thoracic duct occasionally comes into practical consideration as a factor in the dissemination of tuberculosis, especially in children, where mediastinal glands are very liable to infection. The intimate relationship of these structures with the thoracic duct occasionally results in the direct escape of the contents of tuberculous abscesses into the duct, and by this means, via the venous system, the whole of the body becomes infected.

CHAPTER XVI

LYMPHATIC INSUFFICIENCY

THE nutrition of the cellular elements of the body is derived from lymph, which has passed through the walls of the capillary vessels into the intercellular spaces. Having performed its function and become laden with the products of destructive metabolism, the lymph is returned directly into the venules, so that complete equilibrium is established between the secretion and absorption of lymph. This condition of affairs obtains in a limb at rest. When the supply of lymph is much increased, owing to the local needs of the tissues, this balance can no longer be maintained; and another factor, the lymphatic vessels, is brought into play, by means of which the superfluous fluid can be carried away. For example, in the liver, where very great metabolic activity is constantly present, there is a perpetual flow of lymph into the thoracic duct; when a limb is actively moving, or being massaged, there is a copious discharge of lymph along its main lymphatic trunks. In this way the tissues of the body are kept bathed in a moving stream of lymph. Interruptions or any change in the efficiency of this

lymphatic circulation can produce a whole series of pathological conditions.

LYMPHATIC OBSTRUCTION

The simplest of these is produced by an obstruction in the lymphatic trunks, preventing the superfluous lymph from being carried away. Perhaps the best example of this is afforded by the swelling of the arm, which is seen after the removal of the axillary lymphatic structures for carcinoma of the breast. The swelling does not come on immediately, as the limb is kept at rest during the process of healing, any lymph which is poured out being absorbed locally; and even if there should be a slight overflow this accumulates in the interstices of the wound, and there undergoes absorption by the neighbouring lymphatics. When, however, the wound has healed, a barrier of solid cicatricial tissue is thrown across the path of the lymph stream, and swelling of the limb appears. It is interesting to note that the swelling does not occur while the limb is at rest, but as soon as the patient begins to move her arm a lymph-flow is set up, which, being unable to pass away into the main lymphatic trunks, produces oedema of the arm. Although the course of the lymphatic vessels is very irregular and anastomoses between them are very frequent, a collateral circulation between them does not seem to be established very readily when a large number of them

have been removed. To a certain extent, of course, compensation does occur, and new lymphatic glands may be formed; but when a definite lymphatic obstruction has once been set up it is usually permanent.

The oedema which is produced is at first quite loose, and can be completely removed by massage, the lymph being forced into the neighbouring lymphatics. As time goes on, however, this soft oedema becomes largely replaced by a solid oedema, which cannot be removed by any sort of massage. Some fluid, however, can usually be pressed onward into the remaining lymphatic trunks, and a certain amount of diminution in the size of the limb obtained, indicating that the swelling of the arm is not entirely due to solid oedema.

In these cases of solid oedema, the connective tissue is overgrown, owing possibly to the excess of nutrition which it has received. It is interesting to note that in the over-nutrition of lymph stasis the associated hyperplasia is mainly confined to the subcutaneous tissues, affecting especially the fatty layer.

The bones are affected in the more marked cases of filarial elephantiasis, but in the varieties of enlarged limbs dealt with in this section the bones are usually normal.

In a naevoid limb there is a similar increase in the amount of nutrition presented to the cells of

the part, but the lymphatic circulation is normal. Here there is an overgrowth of all the tissues of the limb, including the bones.

It is possible that this constant and very marked contrast is due to the difference in the amount of oxygen brought to the cells in the two cases. In a naevoid limb there is an excess of blood normally oxygenated, and hence a true overgrowth of the limb. In lymph stasis there is stagnation of the tissue fluids and a deposit of fat and fibrous tissue.

A similar condition is observed after some fractures. For example, a patient slipped down while under the influence of alcohol, and fractured both bones of the leg immediately above the ankle-joint; the tibia projected through the skin, making a transverse slit which extended about a third of the way around the limb. The patient then proceeded to walk up a flight of stairs upon the broken end of the tibia, so that the wound became severely infected, and serious suppuration followed. The wound ultimately healed, but by the time cicatrization was completed a wall of fibrous tissue had been formed across the lymph track, producing considerable lymphatic obstruction in the foot, which is now the seat of a marked solid oedema.

Besides these forms of lymphatic obstruction, the causation of which is perfectly apparent, there are other varieties, in which the same condition is produced as the result of disease. Cases have been

reported of lymphatic obstruction to the main lymphatic trunks of the body, such as the thoracic duct or the right lymphatic duct. In some cases obstruction of the thoracic duct has not produced any marked effect, the collateral circulation being sufficiently well established to carry on the work of the lymphatics efficiently. In other cases the obliteration of this structure has been followed by acute distension of the efferent lymphatics, leading not only to oedema, but also to rupture of some of their main branches. This is the probable explanation of the condition known as *Chylous Ascites.* In this affection the peritoneal cavity contains a large amount of distinctly milky fluid, the opalescence of which is found upon microscopical examination to be caused by the presence of free fat globules. Increase in the amount of fat in the diet increases the amount of fat in the ascitic fluid. In some of these cases the rupture has been definitely found either at the root of the mesentery or in the receptaculum chyli. A similar condition has also been recorded, but much more rarely, in the pleura, obstruction being usually caused by a mediastinal tumour near the superior aperture of the thorax. Fluid of the same nature has been collected from the tunica vaginalis.

Lymphatic obstruction may be produced by inflammatory changes taking place in and around the lymphatic vessels: for example, after acute lymphangitis

and after erysipelas. It is commonly seen also after suppurative changes in the lymphatic glands, especially the inguinal set, and it is for this reason that excision of these glands is so frequently followed by troublesome swelling of the leg. When venous obstruction is superadded the condition becomes still more serious; the lymph is not only prevented from escaping from the tissue spaces through the lymphatic channels, but an obstacle is also offered to its absorption by the venous radicles. In one case an attempt to excise a mass of tuberculous inguinal glands led to an injury of the femoral vein; this structure was ligatured, and in consequence gangrene of the leg below the knee occurred, necessitating an amputation through the lower third of the thigh.

There are a number of curious cyst-like structures found in various parts of the body, to which the term lymphatic cyst is sometimes applied on the assumption that they are produced by obstruction to lymphatics; such cysts are found in the side of the neck, and in the omentum. It is, however, doubtful whether this simple explanation, which has also been suggested as the method of origin of small lymphangiectases, represents the true method of formation of these structures. The analogy between these types of lymphatic obstruction and naevi is probably very close, and in a naevus it can certainly be demonstrated that there is no obstruction to the passage of blood. The sources of

the disease must be sought in the walls of the vessels, rather than in mechanical obstruction to the circulation.

In hydrocele of the tunica vaginalis we have a lymph space lined with ordinary endothelial cells, in which the onward passage of the lymph is arrested at the lining membrane itself. In old standing cases this arrest is complete and permanent, and nothing short of operative interference is of any service. In children, however, the obstruction is transitory, and the majority of hydroceles in infants disappear spontaneously in the course of a few months.

Lymphatic obstruction can very rarely be treated directly—that is to say, it is usually impossible to break down the barrier which has been opposed to the lymph path so as to form new channels. In this relationship the treatment of hydrocele of the tunica vaginalis is interesting and instructive. In young children, as spontaneous absorption so commonly takes place, it is usually sufficient to apply some lotio plumbi, mainly as a placebo, and await developments. If after a long time the fluid is not absorbed, tapping may produce not only an immediate but also a permanent absorption of the fluid; probably owing to the removal of tension within the sac, thus allowing the lymphatics to come once more into action. When this fails, a good plan is to puncture the cyst with a fine trocar and cannula, allow fluid to escape, and then to inject

5 or 10 minims of pure carbolic acid through the cannula. In this way the lining endothelium is destroyed, and in consequence absorbed, so that fresh lymphatic vessels are opened up, and a new tunica vaginalis formed around the testis just as a cyst wall forms around a foreign body. In adults tapping is only of value as a palliative measure, and when a radical operation is required the whole or the greater part of the wall of the tunica vaginalis must be removed. An excellent way of performing this operation is as follows: An incision is made over the upper part of the scrotum along the line of the spermatic cord. The testis and its coverings are then pulled up out of the wound, the size of the swelling being reduced if necessary by puncturing the cyst. The cyst wall is freely divided at a point as far removed as possible from the testis and then folded back over the epididymis, being retained in position by two or three sutures. If the cyst wall is very redundant, the excess may be cut away before the sutures are applied. The testis is now returned to the scrotum, all bleeding being stopped with extreme care, and the skin wound closed. The space in which the testis now lies is an artificial cleft in the cellular tissue, and any lymph which is poured out escapes directly into the lymphatics of the scrotum.

Attempts have also been made to remove the obstruction in cases of filarial elephantiasis, but the considera-

tion of this will be more satisfactorily dealt with when describing this disease.

In ordinary post-operative or post-inflammatory oedema, it must be borne in mind that the swelling is at first quite loose, and can be removed by massage. This should therefore be carried out perseveringly, so that the lymph stasis may be kept in check as far as possible; for it is probable that the solid oedema which results is due not only to hyperplasia of the connective tissue from over-nutrition, but also to organization of lymph which has coagulated in its interstitial spaces. In the intervals between the massage, while the patient is using the limb, an elastic bandage may be worn with advantage. India-rubber forms a very efficient material for the bandage, but it has the disadvantage of being very hot and uncomfortable for the patient and of retaining the sweat. More satisfactory bandages are now made of crêpe and stockinette, the efficiency of which is very little less than that of india-rubber. A point is reached, however, at which the effect of massage is only temporary, and permanent enlargement of the limb remains. There is no evidence that drugs such as iodide of potassium have any effect whatever upon this swelling.

OEDEMA OF ARTERIAL OR VENOUS ORIGIN

When the lymphatic vessels remain normal, oedema may be produced by an excess of lymph, which renders

the lymphatic mechanism relatively inefficient. Secretion of lymph depends upon two main factors: (1) the intra-capillary blood pressure, (2) the permeability of the capillary wall. The intra-capillary blood pressure can be raised either by a dilatation of the arterials or by obstruction to the venous outflow. The vascular system is under very close control by the central nervous system, and hence capillary changes may be brought about not only by local conditions but also by affections of the cerebro-spinal nerve centres.

Arterial dilatation is only rarely the cause of oedema, but the following case is probably an example in point: A child six months old, with marked neurotic tendencies in the family history, was suddenly seized one morning with an acute swelling of the left side of the head and neck; the oedema was soft, pitted readily on pressure, and the surface of the skin was flushed. The pinna of the left ear was swollen to twice its normal size. The swelling, with the exception of that of the pinna, rapidly disappeared, but in this latter situation persisted for a couple of days. Disappearance of the oedema from the head and neck was followed by a pulmonary condition, in which an acute oedema probably played a large part, leading to a rapidly fatal issue. In this group a large number of those affections which are classified as angio-neurotic oedema should probably be placed.

Oedema from venous obstruction is well seen in cases

of thrombosis, or after ligature of the great veins. The collateral venous circulation is so free, that a very large number of veins can be obstructed without producing oedema, provided that the lymphatic vessels are intact: for example, it is possible to divide the internal jugular vein on both sides without producing any symptoms whatever. When the collateral circulation is not readily re-established, as in the mesenteric veins, oedema is always produced; and in this situation it almost invariably produces gangrene, a condition which very rarely occurs elsewhere, although, as in the case mentioned above, it is found exceptionally.

In septic cases venous thrombosis is often followed by severe and lasting swelling, an example of which is seen in the condition known as *Phlegmasia Alba Dolens*, or white leg. This is a condition which occurs occasionally after operations upon the lower part of the abdomen, or after parturition. Although there may have been no gross sepsis, and no definite abscess formation or septicaemia, it is probable that in all these cases there is a septic element at work, leading to thrombosis not only of the veins but also of the lymphatic channels. The disease is ushered in by a rise of temperature, and by all the symptoms of septic intoxication; the limb becomes swollen, the oedema at first pitting upon pressure. The skin, as the name implies, is white, smooth, and shiny, and the limb feels heavy and painful. Along the course of the great

veins there is a line of induration which is especially tender, and if the oedema be not too pronounced the thrombosed vein can actually be felt. The absence of cyanosis points to the probability of the lymphatic obstruction being the more important factor in the case, and the subsequent progress of the disease confirms this view. Oedema following simple venous obstruction is usually transitory, but oedema following lymphatic obstruction is usually permanent. The patient is kept in bed for at least three weeks, to allow the thrombi in the veins to become organized and obviate pulmonary embolism. Any septic condition that happens to be present should receive appropriate treatment; and the patient's strength is supported by light and nourishing diet. Drugs are of little value, with the possible exception of large doses of perchloride of iron, the reputation of which in septic cases is probably well deserved. Attempts are sometimes made to diminish the coagulability of the blood by the administration of potassium citrate, a salt, which, by combining with the calcium salts in the blood, prevents the formation of fibrin ferment and diminishes the tendency to thrombosis. There is no objection to the use of this substance, for, acting as it does in preventing the formation of fibrin ferment, it has no action upon the fibrin which has been once precipitated, and will therefore have no tendency to diminish the firmness of the clot which has formed. It should be given in doses of from 10 to

15 grains three or four times a day. It has the further advantage of acting as a diuretic, thus assisting in keeping the kidneys active. No massage should be attempted for at least a month, but after this time has elapsed massage should be employed daily, an elastic bandage being used in the intervals.

TOXIC OEDEMA

The blood-vessels and lymphatics remaining normal, oedema may still be produced by alterations in the permeability of the capillary wall, a condition which may be due either to a local intoxication or to a general toxaemia: for example, the sting of a poisonous insect, or an irritant plant such as the stinging-nettle, is often accompanied by a localized oedematous swelling. The poisonous material acts upon the endothelial cells of the capillaries, so that the fluid constituents of the blood are poured out faster than they can be conveyed away by the neighbouring lymphatics, with the result that they accumulate in the tissues and produce a circumscribed patch of oedema.

The oedema which accompanies septic infection probably falls under this heading also. In acute inflammation of a skin which contains pigment cells, such as the web of a frog's foot, it is possible to see the paralysis of the amoeboid pigment cells, and it is reasonable to suppose that a similar paralysis obtains in the endothelial cells. This is further borne out

by the way in which the blood current is slowed, and the leucocytes adhere to the vessel wall. If the inflammation becomes still more acute, the permeability is so much increased that the blood cells are able to pass between the endothelial cells into the surrounding tissues, the white corpuscles escaping at an earlier stage than the red. In some cases the capillary circulation is arrested completely and the vessel wall loses all power of restraining the exudation, retaining merely the mechanical property of filtering out the cellular constituents. The vessel thus becomes packed with blood cells, separated by a layer of plasma which has not yet coagulated, presenting the phenomenon known as 'stasis'.

In very acute inflammation such as erysipelas actual thrombosis occurs, not only of the blood-vessels but also of the lymphatics, leading to a persistence of the swelling.

It is obvious from the above considerations that the permeability of the wall can only be brought back to normal by the cessation of the exciting cause, but that elevation of the limb diminishes the oedema, by bringing the action of gravity into play.

In many forms of toxaemia, oedema occurs owing to a generalized affection of the capillaries. This is seen in poisoning by lead and arsenic, by many intestinal toxaemias, and in the vascular degeneration of Bright's Disease. In some cases the exudation is so

excessive that even with the aid of gravity the lymph vessels cannot carry off the fluid which is poured out, and tapping of the subcutaneous tissue with Southey's trocar, or drainage through incisions, has to be resorted to.

OEDEMA OF OBSCURE ORIGIN

Beside those oedemas which can be directly and simply ascribed to changes in the blood-vessels and lymphatics there is a group of cases in which the oedema is of a much more obscure origin. It may be said generally, that this type of oedema is caused by changes in the central nervous system, and the term *Trophoedema*, which has been given to this group of cases by Henry Meige, expresses this view. A large number of cases have been described, representing probably a number of very different conditions. The connexion of oedema with a chronic lesion of the central nervous system is well seen in a case of locomotor ataxia with lightning pains recorded by Quincke, in which the area to which the pain was referred became oedematous during the time that the pain was felt. In a large number of nervous diseases, oedema occurs: for example, in syringomyelia, and even in conditions like anterior poliomyelitis, where there is disturbance of the vascular system. The group of cases classed under the heading of trophoedema stands rather apart from these, inasmuch as there is no obvious nervous disease, and no affection

of the cardiac or renal mechanism. In these patients the oedema is usually present in the legs, although a similar condition occurring in the face and arms has been reported.

These cases must be carefully distinguished from hemihypertrophy, a condition which affects not only the subcutaneous tissue but also the bones of the limb. In a typical instance, one or both legs are enlarged to twice or thrice the normal size, the swelling extending from the foot to the upper part of the thigh, ceasing with remarkable abruptness at the gluteal fold behind and at the level of Poupart's ligament in front. Unlike the true elephantiasis arabum there is no affection of the pudenda, a region which is particularly susceptible to the latter affection, and one whose lymphatics have a very close relationship with those of the leg. At the ankle the enlargement usually forms a marked fold, hanging down over the foot '*en pantalon de zouave*'. The foot is usually less affected, although it is rare for it to escape entirely. The oedema is hard, white, and painless, little or no pitting occurring on pressure. Trophic disturbances do not often occur, and except for its weight the limb is as efficient as the one on the sound side. Sensory disturbances are also usually absent.

Puncture of the limb gives exit to a few drops of clear straw-coloured fluid, but this is not followed by an abundant flow of lymph at all comparable to that

which is obtained in cases of renal incompetence. When the tissues are examined histologically, the epidermis is found entirely normal, or at most showing evidence of stretching. The cutis vera is very markedly thickened, but the main increase of the limb is due to an overgrowth of the superficial fatty layer. The hyperplasia of the connective tissue occurs also in the nerves and between the fibres of the muscle.

The causation of the disease is by no means clear, although a knowledge of its etiology would probably throw a great deal of light upon the cause of a great many other kinds of oedema. It is often congenital, but in the majority of cases, it either does not arise, or only attracts attention about puberty. It is a distinctly familiar disease, Milroy reporting twenty-two cases in six generations of one family, and Meige eight cases in four generations of another family. Cases, however, occur sporadically. Some of the cases have followed an injury: thus Etienne reports a case in an oldish man who noticed a pain in his left hand, after a long day's work trimming hedge-poles. He apparently struck the pole with a knife held in the right hand, and reinforced the blow by striking the knife with the palm of the left hand. The pain continued, and shortly afterwards swelling came on in the hand, extending ultimately as far as the middle of the arm. Another case is recorded of a girl, who had

a pain in her leg from the repeated blows of faggots which she was breaking across her knee. In this case the pain disappeared, but swelling came on between the ankle and the hip which presented the typical features of trophoedema. In many cases the final solid oedema has been preceded by a series of attacks of swelling of the commoner loose oedematous character, each attack leaving a slight permanent result which was increased by every subsequent one.

Treatment in these cases is of little value. The swelling, it is true, contains a certain amount of fluid which can be removed by massage, but the effect of this is purely transitory. Iodide of potassium and Thyroid extract are of no value.

CHAPTER XVII

FILARIASIS

The lymphatic vessels are very liable to invasion by a species of nematode worm—the Filaria Bancrofti. Disease produced by this parasite is restricted almost completely to tropical regions, being found in its greatest intensity in the countries between the Equator and the twentieth parallel north, extending, but with less constancy, twenty degrees north and south of this belt. Beyond this area the disease is almost unknown, Cape Colony being the only important affected area. In countries where it occurs it is often very wide-spread, affecting a very large percentage of the population: thus, in Samoa, Königer estimated that 50% of the male population were affected with this disease, including in some instances whole families. The adult worms, which are of fairly large size, inhabit the larger lymphatic trunks, the female being three to four inches long, and the male two to three inches long, and about as thick as an ordinary strand of horsehair. They are found also in the thoracic duct and in the receptaculum chyli. In these situations they are extremely prolific, and give birth to

enormous numbers of small embryos, which pass into the blood stream, where, owing to their small size (their diameter being less than that of a red blood corpuscle), they are able to pass through the capillaries without difficulty. These embryos have the curious property of being attracted to the skin and superficial structures by night, retreating by day into the deeper organs; so that they can be readily discovered by simple puncture of the skin during the night; in some cases their demonstration is extremely difficult, in others they can be found readily in large numbers.

It is probable that it is to the parent worms that most of the symptoms of the disease are due. These not only obstruct the lymphatic vessels by their presence, but they produce a considerable amount of lymphangitis with consequent thrombosis of the lymphatic trunks, so that very complete lymph stasis is produced. It follows from this, that the death of the parent worms does not necessarily cure the disease, at any rate in the later stages. The death of the worm has been supposed to be one cause of the abscesses which frequently accompany this condition.

As a result of lymph stasis, produced in this manner, a number of pathological conditions occur which may coexist in the same patient, and it is instructive to compare these with the distended lymphatics de-

scribed under the heading of lymphangiomata on the one hand, and with congenital oedema on the other.

HAEMATOCHYLURIA

In this condition the patient passes urine which, when it is first voided, is dark, turbid, and opaque. On standing, it separates into two parts, the lower being red and often coagulated, from the presence of blood; the upper resembling diluted milk. Further examination reveals that this milkiness is due to the presence of small fat globules, obviously produced by an admixture with chyle. There is no sugar present, and, in uncomplicated cases, no tube casts. Occasionally the amount of blood and chyle is so great that the whole specimen clots, not only after it has been passed, but even in the bladder. The relationship between the amounts of blood and chyle varies, the latter being almost completely absent from the urine voided early in the morning, and most abundant after a meal; a fact which demonstrates its origin pretty clearly. This condition does not continue constantly, but comes on in a series of attacks, with free intervals lasting for weeks or months. The attack is sometimes precipitated by exertion, but often comes on without any apparent cause. In some cases the patient's general health is not affected in any way, but in the severer forms there is progressive and ultimately fatal anaemia. In these cases the obstruction is probably in the thoracic duct itself, the chyle escaping

actually into the bladder; in one case urine passed in the ordinary way contained chyle, whereas that collected by the ureteric catheter was quite normal.

ELEPHANTIASIS

In this condition the combination between the mechanical blockage of the lymphatics by the parent worms, and lymphangitis, is well seen. The disease is first noticed about puberty: some cases have been recorded in young children, but these are probably due to simple streptococcal lymphangitis. The onset of the disease is sudden, the temperature is raised with shivering attacks, the leg is swollen, painful and tender, and the course of the lymphatics is marked out by red lines running up the leg. The swelling of the leg persists during the height of the inflammation, diminishing when this has passed off, but never quite regaining its normal size. Repeated attacks of lymphangitis follow, the permanent increase in volume of the leg becoming greater after each attack, until ultimately the full clinical picture of elephantiasis is presented. The disease affects not only the leg, but the genitalia, the parts more particularly affected being the scrotum in the male and the labia majora in the female. In rare cases the arm is affected, and one case has been reported of elephantiasis of the tongue. The enlargement of the parts is enormous, the weight of the tumour which he

has to carry sometimes preventing the patient from moving about. The greatest enlargement of the scrotum which has been reported is one recorded by Chevers, in which a weight of 2 cwt. was reached.

The parts affected are distorted in shape, as well as enormously enlarged, the hyperplasia affecting the bones as well as the superficial tissue. The skin becomes rough, horny, and cracked; between the irregularities occasioned by the overgrowth deep sulci form, which retain the sweat, creating suitable spots for the growth of micro-organisms. As a result of this extensive ulceration with decomposition of the discharges occurs, and the whole limb may become extremely offensive. Enlargement of the scrotum to the extent mentioned is, of course, not common, but it frequently happens that the weight is so excessive that mechanical appliances have to be devised to carry it about. The tunica vaginalis is sometimes distended, but in many cases the intra-scrotal contents are normal. The penis, probably owing to its separate lymphatic connexion with the pelvic vessels, is often unaffected, so that it comes to lie at the bottom of a deep pit. In other cases it shares in the enlargement. In the female the incidence of the disease falls almost entirely upon the labia majora, which may reach to the knees or even beyond; only rarely is the clitoris affected. The glands in relation to the affected part are usually enlarged and hard.

LYMPH-SCROTUM

This is an affection allied to elephantiasis, with which it is often combined, but it is characterized by the presence of enormously extended lymphatic vessels, forming cysts at various points. The tunica vaginalis is usually distended. Rupture of the cysts occurs readily, giving exit to a copious discharge of fluid which is usually milky. This lymphorrhagia is produced by a reversal of the direction of the current in the abdominal and pelvic lymphatics owing to the blocking of the thoracic duct.

VARICOSE GLANDS

In some cases of filarial obstruction the lymphatic glands become converted into soft spongy swellings. By pressure, or by putting the patient on his back with the parts elevated, they can be reduced considerably in size; they enlarge once more, however, as soon as the pressure is released, or the patient stands up. There is no impulse on coughing. The commonest glands affected in this way are the inguinal set, but the condition is also found in the axilla.

LYMPHATIC VARIX

In this condition the lymphatics of the spermatic cord are irregularly distended, resembling an ordinary varicocele. They do not, however, form so definite or so continuous a swelling, the enlarged portions of the

vessels being separated by parts where the normal calibre is retained.

CHYLOUS ASCITES

This condition occasionally occurs of filarial origin.

The affections described above, as has been stated, frequently coexist, and indeed they are all varieties of one disease, namely the blockage of large lymph trunks as a result of the presence of the filaria. They all show the imperfect way in which a collateral circulation is opened up, although, it must be confessed, cases occur in which the filariae are present without any symptoms of elephantiasis. That a collateral circulation does to a certain extent occur is suggested by the intermittence found in some varieties, notably haematochyluria. As a result of the obstruction, and imperfect collateral circulation, the lymphatic vessels are enormously enlarged; the thoracic duct, for example, may become as big as the little finger, with walls as thick as a vein of a corresponding size. In addition there is lymph stasis in the connective tissue spaces, which produces its usual effect, namely, a hypertrophy of the subcutaneous tissue, of the interstitial tissue of the nerves and muscles and also marked irregular thickening of the bones. The concomitant lymphangitis leads not only to obstruction of the lumen of the vessel, but also to the formation of a mass of fibrous tissue around it; in cases where the

thoracic duct is obstructed, the inferior, distended portion ends above in a hard fibrous mass produced in this way.

TREATMENT

The treatment of this disease is unsatisfactory, but the fact that its victims are almost entirely confined to the coloured races suggests that there is much to be done in the way of prevention. It is fairly certain that the filariae are introduced into the body by mosquitoes, and hence much benefit may be expected in the future from the war which is being waged upon these pests. Treatment of the disease in its fully developed condition is, it is true, unsatisfactory, but something can be done. In some cases an attempt has been made to remove the parent worms from the inguinal lymphatics, and in others the distended lymphatics in the middle of the thigh have been anastomosed with a branch of the internal saphenous vein. These methods, however, although hopeful, can hardly be said to have become routine surgical operations. The enlarged scrotum, or labia, are often amputated with considerable benefit to the patient; and there does not seem to be any particular risk in these operations, provided the skin can be disinfected satisfactorily. In the leg, diminution in size has been produced by the excision of long strips of tissue cut in the long axis of the limb. The wounds seem to heal normally, and the patients

derive considerable benefit from the operation. A large number of drugs have been employed, mainly with the idea of killing the parent worms, but the fact that none of these have come into general use suggests that their efficiency is at least doubtful.

CHAPTER XVIII

DILATATIONS OF THE LYMPHATIC VESSELS

There are a number of tumours which are characterized by the presence of a large number of dilated lymphatic vessels forming cysts which vary in size from a microscopic cavity to that of a large orange. It is very difficult to decide whether this condition is due to a simple dilatation or *Lymphangiectasis*, the result of a mechanical obstruction, or to a true tumour formation, meriting the name of *Lymphangioma*. The difficulty which most observers feel in classifying the members of this group accurately, raises the question as to whether the sharp distinction, which is usually drawn between modifications of normal tissue and true tumours, is really justifiable. It is certainly true that in the present group, it is almost impossible to draw a sharp line of demarcation in the majority of cases. There are some in which the true neoplastic nature of the disease is undoubted and in which the actual formation of new lymphatic vessels has been observed. These are described as originating from solid columns of cells, which grow outwards from the walls of the pre-existing lymphatics, anasto-

mosing with each other and ultimately becoming canalized to form structures which resemble the normal lymphatics.

Apart from this new formation of lymphatic vessels larger spaces are found lined with flattened epithelial cells which represent enlarged lymphatics, either of new formation or as a result of distension of pre-existing vessels. Besides the actual hyperplasia of the lymphatic structures there is always an overgrowth of the interstitial connective tissue, and in many cases the blood-vessels are also distended. Some authorities have suggested that these new lymphatic vessels are derived not from any existing lymphatics, but from the connective tissue cells in the neighbourhood, which have undergone hetero-plastic changes.

Clinically, lymphangiomata fall into three main groups:—

1. Lymphangioma simplex.
2. Lymphangioma cavernosum.
3. Lymphangioma cysticum.

LYMPHANGIOMA SIMPLEX

The simplest example of distended lymphatics is seen in the sub-conjunctival tissue, in the form of a small nodule made up of clear transparent cords. It is easy to see the nature of these at a glance, owing to their superficial situation and the translucency of the tissue around them. Clinically they are

Fig. 11. Superficial lymphangioma simplex. One of the dilated vessels contains a flake of coagulated lymph. In the lower part of the section small open spaces are seen which are cross-sections of lymphatics not so markedly distended.

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unimportant, as they do not tend to spread, and do not seem to be subject to inflammatory attacks. It is probable that these are true lymphangiectases, that is to say there is no definite new formation of lymphatic vessels, but merely a dilatation of pre-existing lymphatics. A superficial lymphatic dilatation occurs also on other parts of the skin, especially of the trunk, and this type of tumour differs markedly from the one just described, inasmuch as it has a marked tendency to spread; a fact which points to a definite affection of the lymphatic vessels themselves, if not to a true new formation. It is hardly possible to explain their presence on any simple obstructive hypothesis.

Two types are found: in the first the affected area is covered with small light-brown papillary outgrowths, giving the skin a dry and rough appearance; each of these papillae, however, contains a small vesicle which is a distended lymphatic. The affection of the lymphatic vessels rarely goes deeper than the corium, but in some cases reaches the subcutaneous tissue. There may be in addition a cavernous lymphangioma, of an underlying structure. In the second type of case the skin of the affected part is red, smooth, and shiny. Dotted about over the surface are a number of vesicles, varying in size from a pin's head to that of a pea. Both these types are rare, but they are extremely troublesome to treat, on account of their tendency to recur, and also on account of their extreme liability to a dangerous

lymphangitis. This inflammatory trouble has a curative effect, however, inasmuch as it leads to coagulation of the contents of the vesicle. Nevertheless, when practicable, these structures should be excised, or destroyed by the electro-cautery. A type of lymphangioma also occurs mixed with other connective tissue elements, especially lipomata and naevi, and it is in these that we have the nearest approach to a true tumour formation. They are spoken of as lymphangiolipomata, and haemolymphangiomata.

LYMPHANGIOMA CAVERNOSUM

This type of lymphatic malformation has no essential difference in its structure or origin from the previous variety, the small cysts of which are represented by larger irregular cavities lined by endothelial cells. The cystic cavities contain a clear straw-coloured fluid resembling blood plasma, with a few stray white blood corpuscles. Haemorrhage occurs into their cavities, distending them with blood clot, the subsequent organization of which completely obliterates their lumen. The wall of the cyst consists of fibrous tissue and occasionally a few unstriped muscular fibres. Among these there is often a considerable amount of adenoid tissue which is sometimes aggregated to form small lymphatic glands. The lining surface consists typically of a single layer of flattened endothelial cells, but these occasionally multiply, producing

a cellular lining several layers in depth, or even projecting into the lumen to form a sort of intra-cystic growth. This is the type of disease which is occasionally found in the lip or tongue, giving rise to a variety of Macrocheilia and Macroglossia.

In lymphatic macroglossia the whole substance of the tongue is pervaded by a series of distended channels, which in the early stages at least project on its free surface in the form of vesicles. As a result of the distension of the lymphatic channels and the hyperplasia of the connective tissue which is usually associated with it, the tongue becomes enormously enlarged, so that in its later stages it protrudes from the mouth, and even distorts the bony structures of the jaw. Sometimes there is an actual subluxation at the temporo-maxillary joint. Like all lymphangiomata, macroglossia is frequently the seat of lymphangitis, which is dangerous, not only as a septic and painful condition, but as a cause of ulceration and infiltration of the tongue; this unfortunately produces no good effect on the dilated lymphatics, each subsequent attack of lymphangitis leaving the patient's condition rather worse than before. The tongue, which was at first soft and pliable, becomes hard and indented. Fissures and cracks appear on the surface and predispose to further attacks of lymphangitis.

The only treatment which seems to be of any permanent benefit in these cases is the excision of a

large portion of the tongue, combined with suture of the cut edges. In these cases, in addition to the distension of the lymphatic vessels, there is also very commonly an enlargement of the small arteries, so that the surgeon must be prepared for severe haemorrhage, which does not proceed, as in the normal tongue, from one or two vessels, but from a large number of small ones. It is often, therefore, a good plan to commence the operation by ligature of both lingual arteries, proceeding to the amputation of the tongue before a collateral circulation has had time to become established. Two incisions are then carried backwards, so as to remove a wedge-shaped piece of the anterior portion of the tongue. The two cut surfaces are then accurately sutured together, so as to form a new tip, and to arrest haemorrhage.

LYMPHANGIOMA CYSTICUM

In some cases the cysts in lymphangioma attain a very large size. Occasionally a single cyst is formed, but more commonly a large mass is produced consisting of cysts of all sizes, up to several inches in diameter. Between the cysts, the connective tissue undergoes hyperplasia exactly in the same way as in the cavernous lymphangioma, and the wall in the large cysts has the same structure as in the preceding group. Single cysts are occasionally met with in the mesentery and omentum, and in the former situation the contents

Fig. 12. Cystic Hygroma.

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are occasionally milky from the presence of chyle. Single cysts have been described as occurring in the neck, but it is probable that many of these are due to a distension of a branchial cleft. The typical form of cystic lymphangioma is known as the *Cystic Hygroma*: it occurs most commonly in the neck, but is found in other situations, such as the breast. A large swelling is formed usually towards the lower part of the posterior triangle, which is soft in consistency, and with irregular and diffuse outline. The presence of the larger cavities can be readily demonstrated, and between them more solid portions can be felt which consist of the smaller cysts and overgrown connective tissue. These tumours should, if possible, be excised, the operation being conducted on the lines described for the excision of glands in the corresponding region.

The best method of attacking the tumour is by turning up a large flap of skin, sufficient to expose it thoroughly. No consideration for the subsequent cosmetic results should be allowed to interfere with the thoroughness of the exposure, as an attempt to excise a cystic hygroma through a small excision is both dangerous and useless. As soon as the skin has been reflected an attempt should be made to define the important structure, vein, or plexus of nerves which is most liable to be injured in the operation. In the neck the main lymphatic trunks run superficial to the great veins, and in this situation exposure of

the jugular or subclavian vein will commonly indicate the deep limit of the mass. The whole tumour is then steadily excised by a process of blunt dissection, care being taken to remove not only the visible cysts but as much of the fat and fascia around the vessels and nerves as possible, since these structures often contain small cysts, which, although invisible to the naked eye, ultimately grow and produce a recurrence of the disease. When this condition of cystic lymphangioma occurs in such organs as the breast, where a thorough extirpation can be performed, the operation is less risky, and much more satisfactory; but even here, it is usually necessary to perform an operation almost as sweeping as that which would be done for a malignant growth.

In some cases the whole of the tumour seems to consist of one large cyst, which from its size masks the other, and smaller ones, and in such cases it may be somewhat difficult to distinguish a cystic hygroma from a chronic abscess, especially when the cyst has formed rather rapidly.

As the cyst approaches the surface the skin over it becomes thin, and ultimately ruptures, giving exit to a clear straw-coloured fluid. As a result of this, infection is very liable to occur, leading to an acute inflammation throughout the tumour, frequently causing death from acute septicaemia. In some cases a diminution in the size of the tumour, or

even its complete disappearance, has been noted after several attacks of acute lymphangitis, but disastrous consequences are much more common. The fact that inflammatory changes sometimes lead to obliteration of the cyst, and the difficulty of satisfactorily extirpating these tumours, has led some surgeons to abandon operative interference in these cases, trusting to the patient being able to stand the severe strain of recurring sepsis. On the whole, the best treatment is probably a complete and thorough excision.

CHAPTER XIX

LYMPHADENOMA, OR HODGKIN'S DISEASE

This is an affection of the lymphatic glands, the exact nature of which is unknown, although the signs and symptoms are so constant, that there is no doubt as to its pathological entity. The disease occurs most commonly in young people, and affects males much more frequently than females, in the proportion of three to one. It is characterized by a profound constitutional disturbance, being always accompanied by a severe and progressive anaemia with ague-like attacks of pyrexia. The temperature may rise to 102° or 103° without any definite change in the local condition, except perhaps a slight degree of tenderness over the glands. These febrile attacks are followed by a period during which the temperature is normal, the whole cycle being repeated, often with considerable regularity. The characteristic enlargement of the glands is often preceded by a simple chronic inflammation, similar to that which is often found in cases which subsequently develop tuberculosis.

Chronic irritation of the glands is so common, how-

ever, that it is quite possible that this is merely a coincidence, very few children growing up to adult life without having had, at one time or another, some slight glandular enlargement. The disease starts as a rule in one set of glands, most commonly in the neck, and spreads thence to all the other glands of the body, involving also the lymphoid structures of the liver, spleen, intestines, and even skin. Two distinct types occur; in the acute type the glands are soft, and enlarge very rapidly. The anaemia and cachexia are very profound and progress very rapidly, the patient dying of asthenia in three or four months. In the chronic type the progress of the case is much slower, and the patient may live for from three to four years.

The tendency of the glands in the triangles of the neck to be earliest affected, may be due to the fact that these glands are the most liable to chronic irritation; but it is not always the glands, namely the ones at the angle of the jaw, which are most exposed to chronic irritation that are earliest affected, and it is common, quite early in its course, to find the disease widely disseminated. The appearance of the glands is fairly typical, but it must be confessed that the descriptions that are given suggest a sharper distinction between the physical signs in tuberculosis and lymphadenoma than occurs in actual practice, at any rate in the early stages of the disease. The distinction between these

two conditions consists in the much more marked enlargement of the individual glands in lymphadenoma than in tuberculosis. Lymphadenomatous glands may attain the size of a walnut without any evidence of softening, whereas in tuberculosis the glands are pretty certain to have broken down and formed abscess cavities before they have attained this size. In tuberculosis, the glands tend to run together and form composite masses at an early stage, whereas lymphadenomatous glands generally remain discrete much longer, although even lymphadenomatous glands run together ultimately and form large tumours. In lymphadenoma, glandular enlargement is much more widely spread than in tuberculosis, and the presence of large glands in the axillae and groins as well as in the triangles of the neck is very suggestive of lymphadenoma. The liver and spleen are frequently affected with this condition. In tuberculosis, enlargement of the spleen, it is true, does occur sometimes, when the organ is definitely affected with the disease; but the enlargement is never very great, and occurs in cases where the tubercle is so disseminated as to leave little doubt as to the nature of the condition. In lymphadenoma the spleen does not attain to the gigantic size of the spleen in leukaemia, its lower pole rarely reaching a level more than two or three inches below the costal margin. The enlargement of the liver is not commonly very

Fig. 13. Lymphadenoma.

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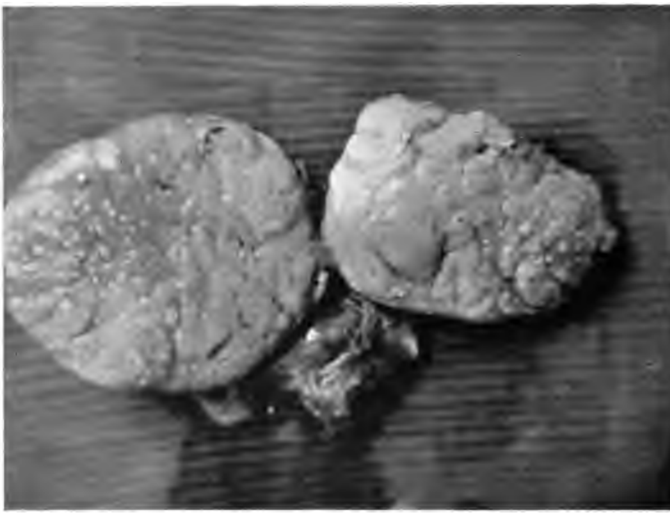

Fig. 14. Lymphadenomatous gland cut open to show the granular appearance produced by the increase in the fibrous tissue.

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marked, although this organ may be studded with small masses of hyperplastic lymphoid tissue.

The surgical importance of these cases is very largely one of diagnosis. When the disease has become disseminated it is of but little use to remove such glands as are accessible, but when the disease is confined to one or two regions it is frequently good practice to excise them, and cases are recorded in which the whole disease was cut short by this procedure. It is rather fortunate that excision of localized lymphadenomatous glands is a distinct benefit to the patient, because it is just this type of the disease which is often so difficult to differentiate from tubercle. Excision of the glands is also occasionally necessary to relieve symptoms of pressure upon veins and nerves.

Excision of these glands presents no difficulties beyond those already described in dealing with tuberculosis. Although the mass may be enormously greater in size, the mobility of the glands renders their removal much easier than the removal of the more adherent tuberculous glands. The glands are firm in consistency, and when cut across have a peculiar granular appearance produced by a great overgrowth of the fibrous tissue. The granulated appearance is quite regularly distributed over the surface of the glands, and the differentiation into cortex and medulla, which is at first unaltered, has disappeared. The capsule of the gland is well defined at first, but later on even this

may be broken through the glands fusing together. Microscopic section of the gland exhibits no changes that are very characteristic, but the fibrous tissue is overgrown, some glands being converted into a fibrous nodule; and scattered among the ordinary lymph corpuscles are a large number of small giant cells. These are much smaller than those found in tuberculosis, and do not exhibit the same arrangement of the nuclei. In tuberculosis these are arranged in a crescent at the periphery of the cell, whereas in lymphadenoma they form a small group in the centre of the cells. The blood in lymphadenoma does not differ markedly from every other type of profound anaemia, and in the early stages blood examination affords no help in the diagnosis between lymphadenoma and tuberculosis; in both cases there may be a slight increase of white corpuscles, especially of the lymphocytes. Examination of the blood is, however, extremely important, as it serves to distinguish at once from leukaemia, a disease in which operative interference is not only useless but actually harmful.

CHAPTER XX

LYMPHANGIO-ENDOTHELIOMATA

In the normal condition the radicles of the lymphatic vessels are lined by a single layer of flattened cells with irregularly crenated margins, the projections of which interlock with those of neighbouring cells. These cells are described as endothelial cells. The term endothelium is very difficult to define, as these cells have definite relationship with the fixed connective tissue corpuscles into which they may actually change. There is also no very definite embryological layer from which these cells are derived, enabling them to be classified sharply. Not only are the lymphatic capillaries lined in this manner, but similar cells are also found lining the great serous cavities of the body and covering the membranes of the central nervous system; structures which, according to some authorities at least, are not derived entirely from mesoblastic tissues. Without attempting to give a definition which shall be rigidly accurate, it is necessary to consider the characteristics of the cells which are found lining the lymphatic system and the blood-vessels; because from these cells is derived a class of tumour, the importance of which

is being realized more and more every day. It is quite certain that, although these cells appear as small flattened plates, their function is by no means merely passive, but that they are capable, under appropriate stimulus, of developing an activity second to no cell in the body. In acute inflammations it is found that they lose their flattened plate-like character, and swell up to the form of a globular cell, with a vesicular nucleus surrounded by an abundant protoplasmic body; which at times contains evidences that the cell is not only growing, but also, as a result of its metabolism, secreting mucin and allied substances. Moreover, it has been experimentally proved that these cells may become actively phagocytic. Again, although the secretion and absorption of lymph are to an extent influenced by the ordinary physico-chemical laws, there can be little doubt that the actively living endothelial cells play a more complicated part than a semi-permeable membrane.

It is not surprising, therefore, to find that these cells, especially those which line the lymph capillaries, are capable of giving rise to tumours which bear the general name of *Endotheliomata.* These may be divided into two larger classes, with only one of which the present section is concerned, namely the lymphangio-endotheliomata and the haemangio-endotheliomata; the former originating from the endothelium of the lymphatic vessels, the latter from the endothe-

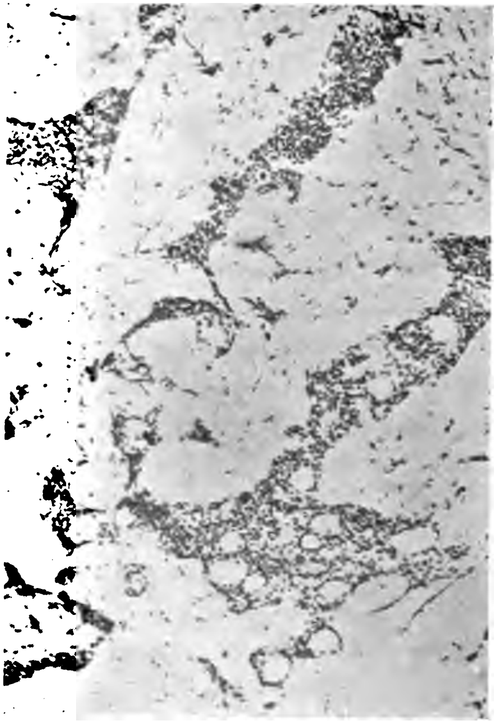

Fig. 15. Endothelioma of parotid showing marked hyaline degeneration.

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lium of the blood-vessels. The lymphangio-endotheliomata may be further subdivided into those which spring from the endothelium of the lymphatic capillaries, and those which arise from the endothelium of the lymphatic vessels. These tumours also arise from the surfaces of the serous membrane, and it is difficult to say whether they spring from the luxuriant network of lymphatic vessels and capillaries which lie immediately beneath the surface, or from the actual surface endothelium.

It has been shown that endothelial cells are capable of great and varied activities, not only secreting serous and mucous fluids, but also taking part in the reparative processes which follow an injury: for example, Thoma has shown that the organization of a thrombus in a blood-vessel is performed entirely by the endothelial cells which line its walls. This versatility of the endothelium is in no way lost when it takes on tumour formation, and there is probably no group of tumours which exhibits such varied characteristics, and such multiform degenerative changes, as that of the endotheliomata. This is so marked that it affords one of the most valuable diagnostic points for identifying these extremely difficult tumours.

The degenerative changes are found not only in the cells, but also in the interstitial connective tissue which lies between them. In some cases, a strand of connective tissue becomes homogeneous, and, fusing with

neighbouring strands which are similarly affected, forms a hyaline rod-like body between the cells. This may be such a prominent feature in the tumour that the term *Cylindroma* has been coined to describe the condition. In some cases this hyaline degeneration is not so well marked, and all that is found is a simple network of anastomosing hyaline filaments. By compression the cells of an endothelioma are sometimes so packed together that they come to resemble a squamous-celled carcinoma very closely, and the conversion of the innermost cells into mere flattened plates strongly suggests a true epithelial cell nest, the nature of which is only demonstrated on attempting to stain for keratin by Gram's method, when it is discovered that, in these cases, there is never any true keratin formation. The absence, too, of prickle cells further clears up the diagnosis between the two kinds of tumour.

Endotheliomata, clinically, form a group of tumours whose malignancy is as varied as their anatomical structure. Thus, a case of parotid tumour had been growing slowly and quietly for eight years, when it suddenly took on a growth as rapid and destructive as the most malignant sarcoma; on the other hand, there are small tumours of the palate, whose malignancy is so low that they earned for themselves the title of Adenoma of the Palate before their true nature as endotheliomata was elucidated. Other cases present a high degree of malignancy from the very start.

Typically, however, their malignancy is low, and removal at an early stage is followed only exceptionally by recurrence. Their power of forming secondary deposits in distant organs is also very much less than that of other kinds of malignant disease.

In structure these tumours resemble cancers rather than sarcomata, although, genetically, they are more intimately related to the latter group; and as the study of these tumours advances, more and more of the anomalous forms of tumours, described under such terms as sarcoma carcinomatosum, are found to belong to this group of tumours. For example, towards the pyloric end of the stomach, tumours are sometimes found which clinically are indistinguishable from a cancer of this region. They occur as a hard mass encircling the pylorus, causing stenosis of this structure and dilatation of the stomach. Their inner surface bears the typical annular ulcer, and in their later stages metastatic deposits are found in the glands around the stomach and in the liver. Microscopically, these tumours have a strong resemblance to the scirrhous cancer of the breast, consisting of small groups of cells lying within the meshes of an abundant supporting connective tissue. The shape of the cell is cubical, and there is no tendency to the formation of the regular gland-like intercellular spaces which exist in the typical true cancers of the alimentary canal. The alimentary canal is lined throughout with columnar

cells, and, even when the structure of the gastric glands is taken into consideration, it is difficult to understand how a tumour resembling a cuboidal-celled carcinoma can be developed in this situation.

Moreover, although in columnar-celled carcinoma, the cells may get packed together so that the typical gland-like arrangement is lost, they do not present in any part of their extent anything similar to the type of tumour under consideration. It cannot, however, be denied that the admission of such tumours into the class of endotheliomata opens up wide questions as to the true nature of a very large number of malignant tumours, which have previously been considered as undoubted cubical-celled carcinomata. So close is their resemblance to carcinoma, that one authority at least has suggested, that the whole of these tumours are in reality endotheliomata; this is not, however, accepted by many observers, as there are many differences which place a sharp distinction between the two groups of tumours.

To understand the structure of endotheliomata, the arrangement of the lymphatic capillaries, in the form of a closely anastomosing network, must be remembered. The proliferation of the cells which line this network of canals, leads to the development of a network of cellular strands, which, by their further modification and degeneration, produce the varied histological pictures presented by the endotheliomata.

At the edge of one of these tumours it is generally possible to make out the true nature of the growth, although in the centre of the tumour mass this may be entirely unrecognizable. In a typical case, at the growing edge of the tumour branching columns of cells are seen in longitudinal and transverse section, consisting of closely packed cells with vesicular nuclei and abundant protoplasm, which from the way in which they are packed together assume a polyhedral shape: beyond these, the cellular columns consist of only two cells, lying side by side; and ultimately only a single layer of cells is found extending between the bundles of fibrous tissue.

It is interesting to note the resemblance between this and the infiltration of lymphatic spaces by cancer cells; but a superficial examination will often demonstrate a difference, which is the expression of a profound difference between the two diseases, although at first sight it might seem to be accidental. After the ordinary preparation of tissue by hardening it in alcohol, the cancer cells shrink away from the space in which they are lying, and in a favourable case this space will be found to be lined by unaltered endothelial cells. These are often, of course, difficult to make out, inasmuch as, owing to the pressure of the tumour cells, they are often atrophied. In the case of the endotheliomata, these strands of endothelial cells do not lie within the intercellular spaces, but actually

compose the walls which line the lymph space; and in an alcohol preparation, where considerable shrinkage has gone on, they are found so intimately adherent to the sides of the lymph space, of which they originally formed an integral part, that little or no separation from the connective tissue of the wall occurs. It should be stated, however, that this view of the constitution of an endothelioma is not universally held, as it is often possible to make out that there is a true injection of the lymph spaces, with cells of the invading growth, exactly similar to the condition which obtains in carcinoma.

Originating as they do in the walls of the lymph spaces and lymphatic vessels, endotheliomata can occur in any organ or tissue of the body. The commonest situation is undoubtedly the salivary glands, especially the parotid. They also occur upon the surface of the serous cavity, that is to say in the pleural, peritoneal and cerebro-spinal cavities; in the lungs they are by no means uncommon; they form tumours of the skin, and one variety of cystic disease of the ovary.

To describe the appropriate treatment of every type of endothelioma would involve a review of practically the whole of operative surgery. In some cases the diagnosis is made only on microscopical examination, and the clinical features are those of carcinoma or sarcoma. In these cases, although the prognosis is

distinctly better than in cases where the sarcomatous or carcinomatous nature of the tumour is undoubted, the treatment should be exactly the same as would be adopted for these conditions. Thus, if a preliminary operation had demonstrated that the tumour in a breast was an endothelioma, there would be no reason for mitigating in any way the thoroughness of the operation; since, although the formation of metastases is not common, it undoubtedly occurs, and it being impossible in actual practice to determine whether or not this has taken place, the whole of the glandular area in relationship to the growth should be removed. Many endotheliomata, on the other hand, present the clinical picture of a non-malignant growth. They do not readily become fixed to surrounding structures; are frequently provided with a very definite capsule; and surrounding structures are displaced by the tumour rather than infiltrated by it. These tumours can be treated in accordance with the clinical picture. For example, an endothelioma of the parotid is an ellipsoidal swelling, moving freely upon the parotid surfaces, leaving the facial nerve untouched, and causing no constitutional disturbances. An incision should be made over the tumour, parallel to the branches of the facial nerve; the capsule is opened, and the mass shelled out by a process of blunt dissection; haemorrhage is arrested, and the wound closed by a few points of suture.

The treatment then, to sum up, is, that the tumour should be removed in accordance with the clinical picture; those resembling malignant disease being treated as malignant tumours, those resembling simple tumours being treated as simple tumours.

CHAPTER XXI

LYMPHOSARCOMA

THIS term is one which has been employed very loosely by certain writers. By some it is confused with Lymphadenoma, or Hodgkin's Disease, a condition with which it may be easily confused in its early stages. The subsequent course of the disease, however, differentiates the two conditions so absolutely, that there is no excuse for the confusion of nomenclature. It is much more difficult to separate lymphosarcoma from other types of round-celled sarcoma, but, with the reservation that our knowledge of malignant disease is too small for a detailed natural classification of these sarcomata, its clinical and microscopical characters are sufficiently distinct to justify us in placing lymphosarcoma in a class by itself.

In common with all sarcomata, it consists of two parts, a mass of actively growing cells and a supporting stroma. The cells of the lymphosarcoma are small round cells with a large well-marked nucleus which stains well with the ordinary nuclear stains. They differ from the normal cells of lymphatic glands merely in being a little larger and being less tightly packed together.

The connective tissue of an infiltrating growth is derived from two sources. In the first place, the tumour cells being derived from the mesoblast—the great connective tissue-forming layer—retain to a certain extent their primitive tendency to form the more highly developed forms of connective tissue, such as bone, fibrous tissues, and cartilage.

The second source of the stroma is from the connective tissue of the part affected by the growth. Around many tumours the cells of the connective tissue are seen to be in a condition of great activity. There is a well-marked infiltration with round cells, and ultimately a considerable quantity of dense fibrous tissue may be developed. As growth progresses this fibrous tissue becomes enclosed in the tumour itself, forming septa between its various cellular constituents.

We find this condition in its highest development in a slow-growing carcinoma: for example, in the so-called atrophic scirrhus of the breast, the fibrous tissue is developed in and around the cancerous mass to such an extent, that multiplication of the cells of the tumour can only take place with the greatest difficulty. Progress of the disease is therefore extremely slow, and, in very rare cases, becomes completely arrested. Lymphosarcoma is a type of malignant growth in which the very opposite condition is found. The connective tissue around the tumour is almost absolutely

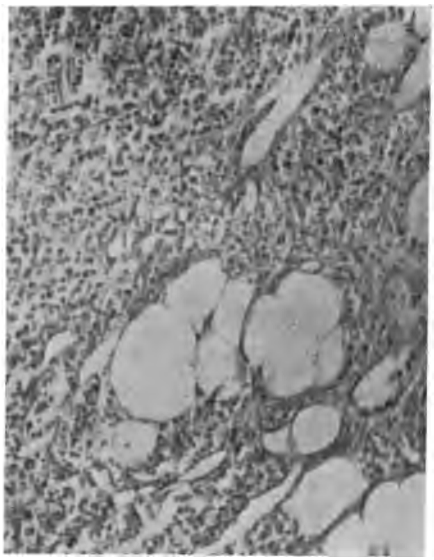

FIG. 16. Edge of a lymphosarcoma showing infiltration of fatty tissue.

To face p. 200.

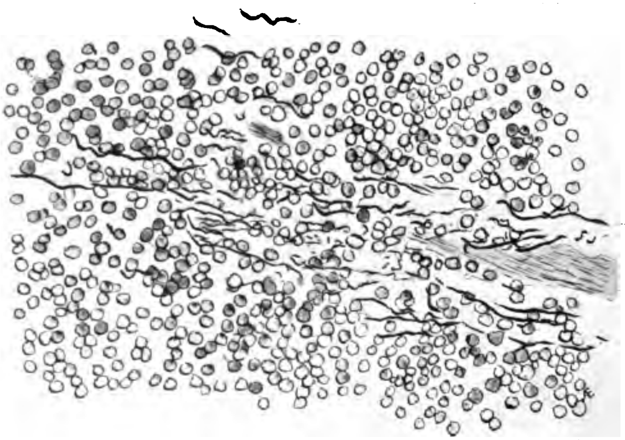

Fig. 17. The invasion of connective tissue by lymphosarcoma. The black lines are the strands of elastic tissue which are derived from a large strand of fibrous tissue, remains of which are seen on the right of the specimen. The connective tissue was drawn with the camera lucida: the rest of the figure is diagrammatic.

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quiescent, there is little or no round-celled infiltration, and a very imperfect wall of fibrous tissue raised as a barrier to its progress. A certain amount of the surrounding normal connective tissue does become included within it, and it is this which forms the greater part, if not the whole of its stroma.

Even these strands of connective tissue appear to be undergoing disintegration, the loose areolar tissue disappearing first, the well-marked strands of fibrous tissue persisting a little longer, and ultimately the elastic tissue alone remaining.

As a result of this infiltrating character we find that not only are strands of connective tissue included in the growth, but that nerves, great vessels, or neighbouring glands in their capsules may become incorporated in it.

This forms a valuable diagnostic point in some cases. In simple enlargement of lymphatic glands any small nerves that happen to be in the vicinity are pressed aside, remaining permanently outside the capsule. When, however, the gland is the seat of lymphosarcoma, the growths early break through the capsule of the gland and surrounding neighbouring nerve trunks or other structures. The presence of a nerve trunk running through a mass of lymphatic tissue is therefore strong evidence in favour of malignancy.

Lymphosarcoma, to sum up, is a variety of small round-celled sarcoma, which grows from lymphatic glands,

or from nodules of lymphoid tissue in such organs as the tonsils, the larynx, the pharynx, or testis. It infiltrates widely and rapidly, with a minimum amount of resistance to the spread.

Clinically, lymphosarcoma is found most commonly in the cervical lymphatic glands, where it appears in the form of a rapidly growing tumour. In its very earliest stages the affected glands are discrete and movable, but very soon the disease spreads beyond the confines of the gland capsules, infiltrating the surrounding structures, and firmly fixing the glands to them. This early fixation of the glands is perhaps the most significant diagnostic feature. Although in tuberculosis it is occasionally found that the glands have acquired a certain degree of fixation, yet this is usually confined to the structures superficial to the glands.

Thus, it is common to find a mass of caseating glands firmly adhered to the deep surface of the sterno-mastoid muscle, but it is less common to find intimate adhesions to the structures deep to them. The only glandular affections which exhibit a degree of fixation at all similar to that found in lymphosarcoma, are acute infective lymphadenitis and secondary carcinoma. In common with other types of malignant disease, lymphosarcoma is accompanied by cachexia, usually to a very marked degree.

It is often difficult to diagnose between an acute

lymphadenitis and lymphosarcoma, as the growth of these tumours is often so extremely rapid; and the large masses which are formed soften, producing definite fluctuation. The skin over the softened portion ultimately gives way, producing deep sloughing ulcers which bleed freely, the case frequently terminating by exhaustion from repeated haemorrhages. In other cases the whole of the side of the neck may become converted into a board-like hard mass. Secondary deposits occur early; the growth infiltrating the wall of the great veins fungating into their lumen and giving off showers of emboli, which are carried to the lungs and other viscera by the blood stream. Pressure symptoms also occur early, and the trachea may be so involved that tracheotomy has to be performed. The nerves become involved, giving rise to neuralgic pain. Venous and lymphatic circulation is obstructed, leading to swelling and congestion of the parts drained by these vessels. As has been mentioned, the accompanying cachexia is profound; and in cases where haemorrhage does not occur, exhaustion, combined with the results of pressure, puts an end to the patient's life.

TREATMENT

It has been seen that lymphosarcoma is a type of malignant disease characterized by the small amount of inflammatory reaction which accompanies its spread. This point is of extreme practical impor-

tance. In removing a mass of cancerous glands adhesions may be met with between the glands and some organ which cannot be removed. It is justifiable in some of these cases to divide the adhesion and to remove the disease, there being a reasonable chance that the adhesion consisted merely of inflammatory tissues, and did not contain actual tumour cells. When, however, a lymphosarcoma has contracted an adhesion to any structure it is practically certain that such an adhesion will contain tumour cells, and unless it can be excised with the affected glands, there is no chance of the patient remaining free from the disease. It is this point which makes the outlook in cases of lymphosarcoma almost absolutely bad. Indeed there is no type of malignant disease which is so hopeless to treat as lymphosarcoma.

Whenever possible, however, an attempt should be made to remove the tumour, but this should only be attempted when it is freely movable. If an attempt be made to excise the tumour when it has become definitely fixed there is not only no hope of saving the patient's life, but the condition is greatly aggravated. The cells of the tumour, which are liberated by the division of adhesions, become implanted in the cellular tissue of the neck, and in a few weeks, or even days, the whole of the wound has become converted into a sarcomatous mass. If the glands are left untouched they have a tendency to

grow in a round mass, and the pressure symptoms are not as severe as in those cases in which, by a diffuse implantation of cancer cells, the whole of the side of the neck has become one dense mass of growth. When excision is practised, it should be conducted on the lines laid down for the removal of malignant glands.

CHAPTER XXII

THE OPERATIVE TREATMENT OF SECONDARY MALIGNANT GLANDS

ALTHOUGH the lymphatic glands and vessels are the seat of almost every description of malignant disease, only lymphosarcoma and some types of endothelioma arise in the lymphatic structures themselves. All the other varieties are secondary to disease in an organ whose lymph drains into the gland in question. The frequency with which glands are secondarily involved varies with the type of disease. Epithelial cancers affect glands early and extensively, sarcomata tend to spread by the veins and infect glands to a lesser degree. In cancer of the tongue, for example, the disease frequently runs its whole course without spreading beyond the glands in the neck, although these glands will often be extensively affected; and it is possible for a sarcoma to bring about a fatal result without affecting the corresponding group of glands, the secondary deposits being entirely visceral. While it is true that no epithelioma can originate in a lymphatic gland, cases occur in which, for some

time at least, the glandular enlargement is the only evidence of the disease which can be detected, and hence the diagnosis and treatment of lymphatic malignant glands has an importance of its own quite apart from the primary growth.

The size of the secondary glandular deposit may be out of all proportion to the extent of the primary growth, a very small and slowly growing nodule being accompanied by an enormous, rapidly growing tumour in the neighbouring lymphatic glands.

It is for this reason that the primary growth is occasionally overlooked, and it is easy to understand this, when it is remembered that superficial glands may receive lymph from deep and inaccessible sources. In the neck, for example, just below the angle of the jaw, they receive lymph from the recesses of the nasal fossae and naso-pharynx, where a small growth may be exceedingly difficult to detect. In this region diagnosis is usually made by rather complicated optical methods, and a non-ulcerated epithelioma may be very difficult to see although it may be quite easily felt. When it is suspected that glands are the seat of carcinomatous enlargement, too much reliance should not be placed upon posterior rhinoscopy and similar methods, but the pharynx and naso-pharynx, the aperture of the larynx, and the various folds and fossae in this region, should be thoroughly explored with the finger; an anaesthetic being given, if the

examination cannot be satisfactorily conducted without pain.

It is not common in other regions of the body to find masses of enlarged glands without an obvious primary source. While it is true that the superficial glands may be enlarged in visceral cancer, this does not commonly occur until the primary disease has made such headway that its presence is unmistakable.

Invasion of the lymphatic system by malignant disease presents two main types which are, however, not sharply marked off from one another. In the first type the tumour cells escape into the lymphatic capillaries, multiply there, and produce extension of the disease in direct continuity with the primary focus. In the second type the tumour cells pass along the lymphatic trunks, until they become arrested in the lymphatic glands. The actual point of arrest is the lymph path, and it is from this part of the gland that the spread of the disease takes place. The cuboidal-celled carcinomata affect mainly the first type of spread; the squamous-celled carcinomata the second.

Malignant glands are usually firm and hard; they very readily fuse together, not only on account of the inflammatory process which surrounds the actual malignant disease, but also on account of the rapidity with which the malignant cells perforate the capsules of the glands and grow in the surrounding areolar

tissue. Not only do the glands become fixed to each other, but they very early become adherent to surrounding structures. These are not displaced by malignant glands, but become surrounded by them, and actually incorporated in their substance—a point of great diagnostic importance. A nerve traversing a mass of tuberculous lymphatic glands, although there may be very extensive glandular enlargement, seems to suffer little, if at all. In the case of a mass of malignant disease under similar conditions, the nerve is infiltrated and destroyed, so that impulses can no longer pass along it. In the latest stages, owing to the fact that the epithelial cells readily undergo degenerative changes, the glandular mass may soften so that the swelling produced resembles an acute abscess; the history, however, will usually clear up the diagnosis.

The removal of malignant glands must be conducted on lines somewhat different from those laid down for inflammatory affections, as it is highly important to remove, not only the glands, but the lymphatics connecting one to the other, and the whole of the fat and fascia surrounding them. No regard should therefore be paid to cosmetic results, an incision being adopted which gives the best access to the parts, and any structure which is not absolutely vital must be sacrificed if it interferes in the slightest degree with the thoroughness of the operation.

As an example of the method of removing these glands an operation for excision of malignant glands from the upper part of the neck may be taken. If the glands are adherent to the skin, but not so firmly connected to the deep structures as to render the complete removal hopeless, the whole area of skin should be marked out with a knife, so that it can be taken away with the glands. Having made an incision around the affected portion of skin, the wound may be enlarged by other incisions so as to thoroughly expose the glands. When no skin has to be taken away, an incision may be made, starting below the chin and passing backwards with a curve downwards to a point behind the posterior edge of the tumour. From this point an incision is carried downwards and forwards towards the sternal notch, and the flap of skin thus marked dissected up and reflected. The sterno-mastoid muscle is then identified, and the deep cervical fascia divided at the line along its anterior border where the fascia splits to enclose the muscle fibres. The internal jugular vein must next be exposed below the tumour, and it will then be possible to make out, whether this structure is adherent with the deep surface of the mass or not. If there is any doubt about this point, a ligature should be carefully passed around the vein and the vessel divided, its upper end being secured temporarily by a clamp. It will now be possible to turn the whole mass of glands upwards

unless there are adhesions to the deeper structures of the carotid sheath. When these are present, it is almost certain that the operation is futile. Removal of the carotid artery or vagus may be necessary, but it is very far from being free from risk, and it is doubtful whether such an operation is any real advantage to the patient. As the glands are turned upward they are freed along their anterior border from the infra-hyoid muscles, the fascia over which should be removed with the glands; no attempt being made to save any of these structures which are implicated. When the level of the spinal accessory nerve is reached, it very often will be found that the glands are entirely superficial to the nerve, and in this case the structure should be preserved. Here again, in any case of doubt, the nerve should be divided, and a portion of it removed with the tumour. The upper end of the tumour may now be freed by dividing the fascia along the attachment of the lower jaw, and to the hyoid bone, the fibres of the various muscles being exposed and identified as the operation proceeds. Occasionally, on its deep surface it will be found that some of the posterior fibres of the mylohyoid are affected, and they should, of course, be removed; further back the posterior belly of the digastric comes into view, and may, or may not, be preserved, according to the degree of fixation of the tumour to it. It will now be found that the only

thing, which is holding the glands in place is the internal jugular vein, and this may now be ligatured at its upper end and divided. The wound is closed in the ordinary way, drainage by means of an indiarubber tube being employed if there has been much oozing or if haemorrhage cannot be satisfactorily stopped.

If owing to the removal of skin the wound cannot be completely closed by simple suture, an attempt should be made to close it by some plastic operation. It is frequently possible to turn a flap up from some other part of the neck, or even from the front of the chest. If the wound cannot be completely closed it is often possible to cover in the vessels, leaving a raw area over the muscles. This forms a much more suitable site for the application of skin grafts, which should be put on as soon as the wound is healthily granulating.

The very greatest gentleness must be employed in handling these glands, as it frequently happens that one of the glands is softened, and may be quite readily ruptured. In the case of a tuberculous gland the dissemination of tuberculous pus into the wound, strangely enough, rarely gives rise to trouble; but the escape of the contents of malignant glands into the cellular tissue almost inevitably converts the whole wound into a diffuse cancerous mass. If a gland should be broken in the course of the operation, it may sometimes be possible to avert this calamity by

cauterizing the whole wound with undiluted carbolic acid, or with chloride of zinc, but even where this precaution has been taken infection of the wound may follow. It is for this reason that it is so necessary that these glands should be excised according to a definite rule, the blunt dissection which is admissible in tuberculosis finding no place in the treatment of malignant disease.

In the axilla, malignant glands are not common apart from disease of the breast, where their removal is simply a part of the operation for excision of the breast. In some cases, such as the sarcoma or carcinoma of the hand, it is sometimes necessary to thoroughly explore for malignant disease in the axilla, and in these cases it is not sufficient to make an incision through the floor of the axilla and remove such glands as are obviously enlarged: a large flap of skin should be marked out with its curve outwards. Starting from the middle of the clavicle this incision is carried across the great pectoral and finally runs along the lower border of the muscle. The fibres of the muscle are then divided so that a large musculo-cutaneous flap can be raised, exposing the axilla from the front. If the pectoral minor interferes, it can be divided and its ends reflected; it will then be possible to define the great veins below the glands, and to clear the whole of the glands and fascia from the axilla space. When the operation is concluded, the muscles

can be sewn together with catgut and the skin closed in the usual way. It is better in all cases to put a drainage tube just in front of the posterior border of the axilla.

Malignant disease of the inguinal glands presents very little difficulty as regards removal, if removal is really practicable, as they are situated superficially to a well-defined fascial layer, and can be readily dissected away. Care should be taken that a wide area of fat and fascia be removed with them. After removal of glands which accompany malignant disease, it occasionally happens that a microscopic examination of some of the enlarged glands shows no evidence of malignancy, the enlargement being merely due to chronic inflammation set up by the growth. This fact should not, however, lead to the slightest diminution in the thoroughness with which such glands are removed, as it is impossible to say, without microscopic examination, which glands are affected; and even in a microscopic section it is quite possible to overlook a small malignant deposit. The germinal centres are often extremely prominent in the chronic inflammation accompanying the disease, and may be mistaken for cancerous deposits, but if the points which have been mentioned be considered as to the structure of these masses of cells, it is usually quite easy to differentiate between a germinal centre and a malignant deposit.

CHAPTER XXIII

THE TREATMENT OF INOPERABLE MALIGNANT GLANDS

Malignant disease by the time it has become inoperable is usually situated in the lymphatic glands. There are many cases in which the primary growth can be removed, recurrence taking place in the corresponding lymphatic glands, where it is no longer amenable to surgical treatment. For example, in carcinoma of the tongue the primary growth can be removed in the majority of cases with no local recurrence. The glands of the neck, however, are often so infiltrated and have become fixed to the vessels and nerves so early, that complete extirpation of the disease is impossible.

Although surgical interference is out of the question much can be done to help the patient. In a certain percentage of cases—unfortunately a small one—enlargement of the glands disappears under treatment, and the patient remains well: in most cases the symptoms of the patient are capable of amelioration.

A large number of so-called 'cancer cures' have been devised, many of which are known to the public, who

are anxious that they should be tried, in order that no stone may be left unturned in the attempt to save a patient whose case has been given up as inoperable.

It is at first sight rather surprising that so many of these 'cures' have been devised for a malady of the nature of carcinoma, especially as all of them are substantiated by lists of successful results.

Errors of diagnosis undoubtedly provide the majority of these, but undoubted cases of malignant disease are reported as relieved.

The rate of growth of a malignant deposit varies, not only in different cases, but in the same case, and the variations are often considerable. A tumour which has been quiescent for years may take on extremely rapid growth, and, conversely, a tumour which has been growing with extreme rapidity may become quiescent. Not only does the rate of growth vary, but the amount of pain and constitutional disturbance vary also, although there is no definite relationship between them; a tumour which is growing rapidly and uninterruptedly sometimes ceasing to cause pain. The coincidence of the administration of some remedy with the commencement of a quiescent period gains for the drug an enormous reputation, which a long list of failures impairs but little in the public estimation. The mental factor is also very important in these cases, and any form of treatment which inspires the patient with hope of recovery, will have an enormous

effect, not only on his happiness but also on his pain and general well-being.

X-RAYS

The most valuable agent, which has hitherto been introduced for the treatment of inoperable malignant disease, is the X-ray. The exact mode of action of these rays has not yet been determined, and there is considerable disparity in the results obtained; some cases deriving considerable benefit, while others receive little or none.

It is not possible as yet to be certain, whether a given case will improve or not under this form of treatment; but the chances of improvement are sufficiently great to justify the employment of the X-rays, wherever malignant disease cannot be removed. The treatment is not without risks, as a troublesome dermatitis, which may actually go on to ulceration, is set up in cases where the exposure has been excessive. The degree to which the exposure can be pushed must be judged by experience, for there is a long latent period, varying from four or five days to three weeks, between the exposure and the dermatitis.

The presence of a single layer of clothing or lint between the patient and the tube seems to check the irritant effect to a very large degree, so that in expert hands severe dermatitis is uncommon. Even when it occurs it often has a markedly beneficial effect on the

swelling. In some cases thin flat bags containing thorium nitrate are bandaged over the affected part and the patient exposed through them. The effect of the rays is slightly increased, and as the thorium nitrate has a certain amount of radio-activity, the effect can be prolonged by leaving the thorium bags in position.

The disadvantage of X-ray treatment is its tediousness; the patient having to submit to repeated exposures extending over a considerable period of time. These can be most conveniently given in courses lasting a fortnight or three weeks, with an equal interval between them. As time goes on, the patient's skin becomes more susceptible, and the length and number of the exposures must be diminished.

When the patient's circumstances preclude such frequent attendance the exposure may be prolonged, a maximum dose, measured by the 'Sabouraud pastille', being given. This is a greenish-yellow disc, coated with barium platino-cyanide, which changes to a brownish tint under the X-ray; and when the colour matches a given standard, as large a dose as can be given with safety has been administered.

This maximal dose should be given every fortnight or three weeks, and although it is not as satisfactory as the more frequent exposure, it can often be employed where the other method is impossible.

The treatment should be continued until it is obvious

that no benefit is being derived, and that the case is too extensive to admit of any hope of improvement. Even in these cases, pain is often considerably relieved, although the disease is progressing. The relief of pain is often obtained quite early in the course of treatment, even during the first week.

X-ray treatment finds an application not only in the case of definitely malignant glands, but also after such glands have been removed. Recurrence does not mean that the disease has started *de novo*, but that a small portion has been left behind at the operation.

Malignant disease is a condition to which the body does not submit without a struggle, although the result is rarely in the patient's favour. It is therefore just those cases, in which there is a small nodule of malignant tissue starting to grow under adverse conditions, which are most likely to be benefited by X-ray treatment, and wherever possible, after excision of malignant glands, the area operated upon should be exposed to radiation, and the process continued at intervals for a considerable time, usually about two years.

The results of X-ray treatment are exceedingly encouraging; a large number of cases, where there was definite inoperable malignant disease, having recovered and remained well. It is more difficult to be positive as to the value of the treatment for preventing recurrence, but cases which seemed absolutely

hopeless, have remained well for years under this treatment.

RADIUM

This agent would be as valuable as the X-ray or perhaps even more so; unfortunately, however, it cannot be obtained in sufficient quantity for the treatment of large areas, such as recurrent glands.

VACCINE TREATMENT

In malignant disease cachexia is produced in two ways. Firstly, by the actual products of the tumour cells' metabolism; and secondly, by those formed by the various septic organisms which accompany breaking down of the tumour cells. There is one organism, the Micrococcus neoformans, which is fairly constant in malignant disease. The relation of this organism to tumour formation is a matter of dispute, but it is probable that it is a factor in the resulting cachexia. A vaccine can be prepared by making an emulsion of an agar-culture in salt solution. The opsonic index should be taken and a dose of the emulsion, equivalent to a thousand million of the dead micrococci, injected. As a rule the index rises very rapidly, and a fresh dose can usually be injected in about ten days. Although there is no evidence that the increase in the patient's resisting power to this organism has any direct action upon the growth of the tumour, yet it may have some action in reducing the amount of inflammatory action,

and so causing a slight diminution in the size of the tumour. In some cases the toxaemia produced by a malignant growth produces constitutional disturbances in other parts of the body; thus, it is common to find that patients with secondary glands following cancer of the breast suffer from a particularly intractable type of sciatica, although there are no secondary deposits around nerves of the lumbar or sacral plexus. These cases sometimes experience considerable relief from this method of treatment.

COLEY'S FLUID

This is a mode of treatment which, like the X-ray, affords a definite but slight hope of curing the disease. This fluid, which is a mixture of the filtered toxins of the Streptococcus erysipelatus and the Micrococcus prodigiosus, is valuable in some types of sarcoma, but in true cancers has little or no effect. Its administration must be conducted with caution, as it occasionally gives rise to rigors and other signs of severe constitutional disturbance. The fluid, which is always slightly turbid, should be injected with strict antiseptic precautions in the neighbourhood of the growth, or into its substance, and into the general circulation. In all cases the patient should be kept in bed, at any rate until tolerance to the injection has been established, and the temperature carefully recorded on a chart. A certain degree of inflammation follows the injection,

but if due antiseptic precautions be taken there is little fear of any abscess forming. It is, however, well not to inject too often at the same spot; varying the site from day to day, and only injecting into the tumour on alternate days. The first day a dose of half a minim should be injected immediately over the tumour; the next day a similar dose may be given into the general circulation, the injection being made into the substance of the triceps muscle or into the flank. If there is no marked rise of temperature on the third day, a minim may be given; either injected into the tumour or divided between the tumour and the flank. It is usually possible to give a daily injection, increasing the dose by a minim every day until it reaches 5 minims. About this point the patient often begins to show signs of reaction, although this may take place with a much smaller dose.

A few hours after the injection the temperature rises, sometimes reaching 103 or 104, with occasionally well-marked rigors, rapid pulse, coated tongue, and all the symptoms of an acute febrile disturbance. Injections must then be stopped for a day or two, until this has passed off, when they may be recommenced, injecting the same dose as before. When the patient has become habituated to this amount of fluid, and only gets a very small rise of temperature after the injection, the dose may be increased and this process carried on until a maximum of 15 minims is reached. It will

then usually be found necessary to cease the treatment for some time, as the patient is often exhausted by the injections. After a week or a fortnight the injections should be resumed, commencing with a dose considerably smaller than that last employed: for example if the last dose injected was 15 minims, it is as well to recommence with a dose not larger than 10.

With doses of this size (15 minims) it is not necessary to inject more than three times a week, and the injections should be persevered with, until the growth has completely disappeared, or until it is evident that no benefit accrues from the treatment. After the growth has completely disappeared, it is as well to give a couple of courses of injections as a preventive against recurrence.

VIOLET LEAVES

Salmon, in the *New London Dispensatory*, printed in 1676, says that: 'the Leaves cool, are Emolient, and Anodyne, often used in emolient Clysters, Cataplasms, &c. They help hot Inflammations, burning Eyes, and the stinging of Scorpions. Inwardly they help the Epilepsie in Children, Quinsey, Surfeiting, heaviness of the Head, and loosen the Belly.' It is probable that in this description the action of the leaves is as well described as in any other. Recently this remedy has been extensively employed, and many cases report

themselves as better after commencing treatment. There is not much evidence, however, of any permanent good results, and the cathartic action mentioned by Salmon must be borne in mind, as in some cases a troublesome diarrhoea has occurred. The dose advised is 30 violet leaves a day: the leaves are infused for twenty-four hours, and the resulting infusion divided into two; half of this is administered as a draught, the remainder being employed for external applications, either as a fomentation or douche.

CHIAN TURPENTINE

Good results have been recorded from the use of Chian turpentine, which is injected into the subcutaneous tissue of the buttock. The turpentine is made into a 20 per cent. solution with sterile olive oil, and the dose for the first injection is 5 minims of this solution. The dose is increased daily by about 5 minims, until 20 minims is reached. This dose is then injected daily.

SOAP

Sodium oleate is administered in 1 per cent. solution, starting with 5 minims, and increasing daily until a maximum dose of 60 minims is obtained. Combined with this, it is recommended to give purified ox-gall by the mouth in half-drachm doses.

TRYPSIN, ETC.

The administration of ferments by mouth or hypodermically is still under its trial. This method of treatment has been introduced on theoretical grounds, the soundness of which is open to question; but some cases seem to have derived sufficient benefit from the treatment to warrant its employment. It is administered usually by hypodermic injections, commencing with 15 minims of a 2 per cent. solution, which is increased by 5 minims on alternate days.

All these varieties of hypodermic medication are painful, but the pain can be largely overcome by injecting a small amount of eucaine through the same needle; they cannot be regarded as curative measures, and their mode of action is uncertain. It is possible that they act by producing a generalized leucocytosis, which has an effect upon the septic conditions so often accompanying malignant disease. That some such explanation is the true one is very strongly suggested by the similarity of the results obtained by the injection of such dissimilar substances.

THYROID EXTRACT

This is often given for malignant disease, especially when the primary source is in the breast. Its administration must be conducted with the ordinary precau-

tions exercised in the exhibition of this drug, and a careful watch kept for symptoms of cardiac trouble.

NUCLEIN

Nuclein is sometimes given in the same way as the substances referred to above, and the efficacy of this substance suggests that the explanation given of the action of such substances as trypsin, sodium oleate, and turpentine are at least partially true, as this substance is known to produce a marked and definite leucocytosis.

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